WORK

An Illustrated Magazine of Practice and Theory

FOR ALL WORKMEN, PROFESSIONAL AND AMATEUR.

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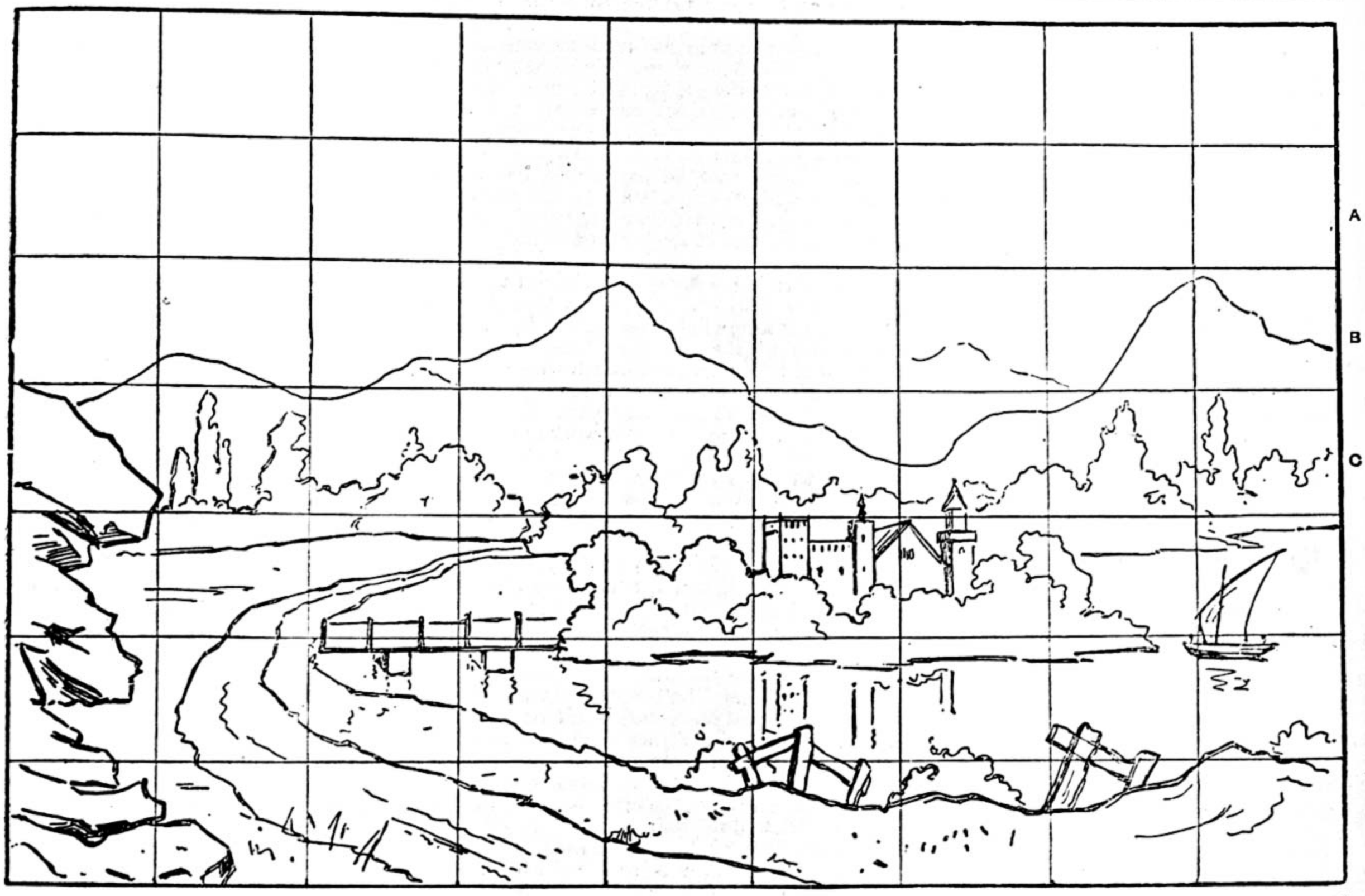

Fig. 1.—Diagram exhibiting Cloth divided into Squares with Charcoal Lines and Outline of Subject sketched on Cloth.

THE ART AND PRACTICE OF SCENE PAINTING.

BY WILLIAM CORBOULD.

SUBJECT FOR FIRST ATTEMPT—TRACING SUBJECT ON CLOTH—PAINTING THE SKY—CLOUDS.

Subject for First Attempt. — On selecting a subject as a preliminary essay, let us choose one as simple as possible, for the greater the simplicity and breadth the more charming will the picture appear when finished. To this I may add that too much complexity is always to be avoided if the stage is small; the subject should be painted as broadly as possible, for too much detail and overcrowding would ruin the best subject.

Let us take, for our first attempt, a rural landscape, as shown in outline in Fig. 1, disregarding the horizontal and vertical lines, which appear in the diagram, and on which I will touch presently. Assuming that the would-be scenic artist has a little knowledge of perspective, he has to carry it out in colouring—that is, by keeping the distance low in tone, and gradually strengthening the tone of all the colouring as he advances to the foreground of his subject. All distant and middle tints must be worked up with greys, such as the sky colours, blues, and greys that have been used in the sky, judiciously working them with the colours that are being used in your distance. I do not mean that the colours are to be mixed one with the other before putting them on, because that would make them like so much mud, but by lightly touching and laying on the colours one against the other, without mixing them. By proceeding thus the artist does not lose his tint, but the greys, such as the sky colour, when used in juxtaposition with the other colours, will give the scene that aërial perspective without which it would be hard and unnatural. It must be remembered that the further the distance is the more grey it must become. The use of a little lake with the greys in the far distance will help the perspective wonderfully, which in some cases, when seen from the front, should appear miles away over the country.

Our subject, as outlined in Fig. 1, has in it all that is required to make it attractive and picturesque, containing, as it does, distant mountains, foliage, water, rocks, the winding road, etc. I have chosen it as a good lesson for painting in perspective, which I shall explain further on. I think that now we may commence our work, taking it in a systematical manner, and dividing it into four parts or stages, of which the first will be the drawing in with charcoal, and covering all the charcoal lines with vandyke brown; the second, painting the sky, clouds, etc.; the third, laying in all the local and flat colours; and the fourth and last, the finishing of the whole.

Tracing Subject on Cloth.—Should the artist have a drawing or engraving from which he is taking his subject, it will be as well to divide it into squares by horizontal and perpendicular lines. Supposing the

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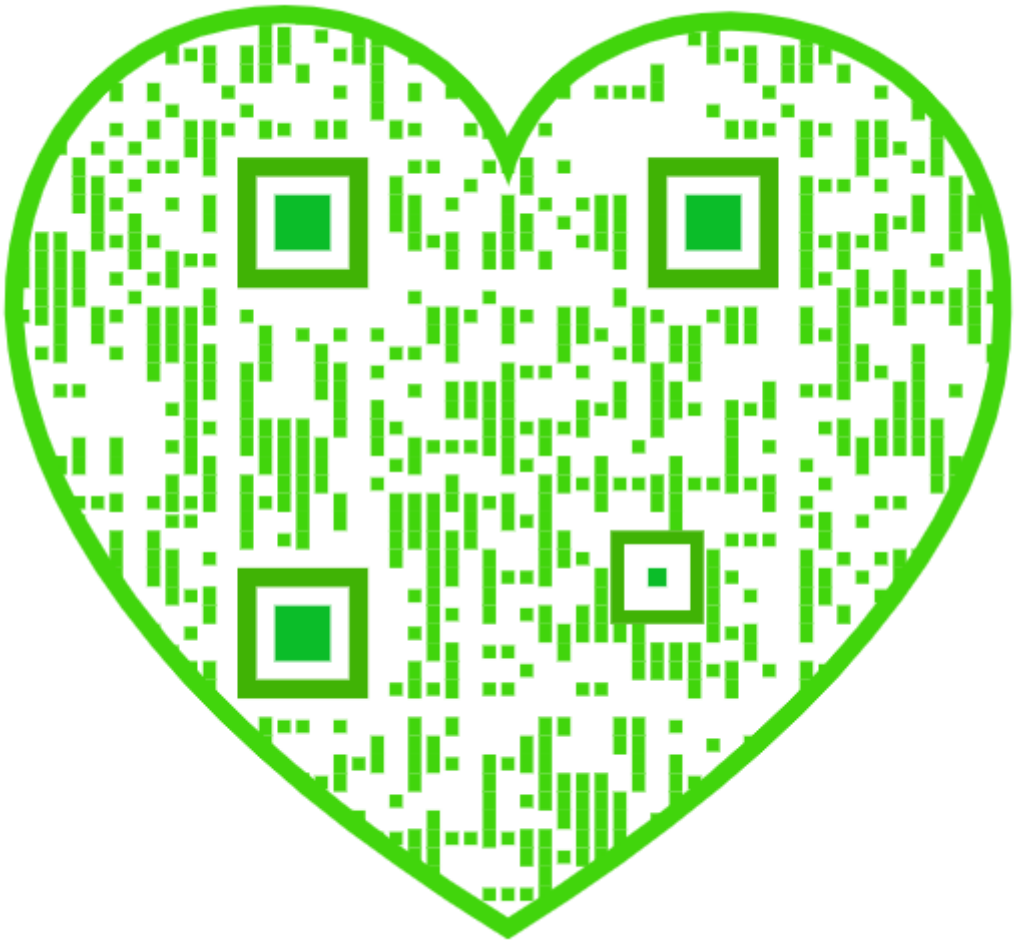

scene is about 15 feet long and 12 feet high: divide the drawing by dots all round the margin at equal distances from each other, and draw fine lines across from dot to dot, as in Fig. 1.

He must now divide the cloth on which he is going to paint into squares in the same way. The same number of dots or points he has on his drawing he must have on the cloth, dividing the spaces equally, as on the drawing. He may now, if he likes, take one of his cords or lines, and rub it with charcoal, and obtaining the assistance of another person to hold one end of the line, while he himself holds the other end, stretch the line tightly from dot to dot. This done, lift the line from the cloth, and let it go smartly back, and by repeating this for every opposite pair of dots, faint lines will be made on the cloth corresponding to those on the drawing, as shown in Fig. 1. If the artist has a rod or straight-edge of sufficient length at hand, he may dispense with the cord for making the horizontal and vertical lines.

It will now be seen how easy it is to enlarge a small drawing to any size by this method. Whatever part of the small picture the lines fall on, it will be the same in the larger scene, and the different parts of the subject in each square will be the same as in the corresponding square in the original drawing, only on a larger scale. The outlining of the whole scene should now be commenced with all the large details, leaving the smaller ones for the finishing. All this is done with charcoal. When the outlining in charcoal has been done to the artist's satisfaction, let him take a small pot, such as a gallipot, if he has not got any earthen paint-pots, and put into it some vandyke brown mixed with double size—that is to say, size which has only a very little water in it. Well mix this, and with a lining-brush or a small fitch go over all the outlines of the picture with the vandyke brown, with the exception of the lines forming the squares, which have been used to assist in the drawing in of the scene. When the vandyke brown is all dry—and care should be taken that it is so—the artist must take his flogger, and whip off all the charcoal he can. This will leave a clean surface to work on, and the outlines of the subject will remain visible through the future paintings till the finish. After some practice, the scenic artist will be able to dot out a scene of this class without the aid of the square lines.

Painting the Sky.—He now commences painting in the sky; and I may point out here that the mixing of this first colour is the most difficult of all—that is to say, the mixing of any and all other colours. I have known several scene painters who have been very good painters in regard to everything but the sky, in which they failed through using ultramarine "blue." I suppose they had not been under the tuition of an experienced scene painter. Ultramarine turns grey in any artificial light, and if used strong will look positively black. If the artist has not a nice blue, he cannot make a good scene. To get a good blue for the sky, we must make a compound of three colours—celestial or azure blue, emerald green, and whiting, in nearly equal parts, using one's own judgment as to depth of colour. Should there be some priming left, it will do without soaking more whiting. Supposing the artist has three pounds in weight of white, he would require about two pounds of emerald green, which colour must be rubbed up into a thick paste with water, and then put in with the white. Then take about a pound and a half of azure blue, if you use this colour; but if you use celestial blue a pound will be about enough. Mix this also into a paste in water before putting it into the whiting, and well beat all up together before adding the size. This beating up prevents the colours from working streaky. After this colour has been mixed, the artist must try it by taking a piece of white paper, and putting with a brush a dash of the colour on the paper. Dry it, and if it should be too blue when dry, add a little white; but be careful in doing this, as the whiting is powerful in subduing the tone of colours, so put in a little at a time, and try the colour again. If when the colour is tried it should be too light, add a little blue; but if you have to add much blue some emerald green must be put with it. Emerald green will look blue by gas-light, as I have said in my general remarks on colours under artificial light. Again, the colour must be tried on paper and dried, for the artist *must* satisfy himself that he has a nice tint to suit the subject before starting his work. Assuming he has arrived at that conclusion, he may now start at the top part of the sky with the blue, always bearing in mind that the top part of the sky is deeper in tint than nearer the horizon. Supposing that the artist is painting a light evening sky, let him commence at the top right-hand corner. After well filling his stock-brush with blue, let him lay it on, crossing and recrossing the work, so as not to miss any part. Lay off lightly from left to right, and work quickly, so that the work may be kept wet. He must not touch any part of the blue he has finished off, but keep working on the left edge, covering the sky about a third down with the blue. The division of the sky portion of the scene into thirds is shown roughly by the letters A, B, C, placed at the sides of Fig. 1. Now let him put some damp lake and yellow ochre on his palette board: this is when and where the artist begins to use the medium, which should be about half size and half water. It should be ready to hand in a small pail or large pot placed on the corner of the palette board with a spare brush in it, so that when any of the medium is required on the colours the brush may be lifted out, and the medium allowed to drain on the particular colour or colours that are to be used. If the brush that the artist is painting with be dipped into the medium, it is obvious that it would be soon unfit for use, but by keeping a clean brush in it the artist avoids making it dirty. These deviations are necessary in order to save the beginner a deal of trouble, and also to impart what has been learnt by experience.

The artist is now supposed to have some damp lake and yellow ochre on the board, and he must put on these sufficient medium to thin out the colours. Take a clean stock-brush, dip it in white, then dip one side of the brush in damp lake, the other in yellow ochre. Lay this on the cloth from the blue downwards, over the middle third part of the sky, well covering the canvas by crossing and recrossing it with the brush as lightly as possible, mixing the colours as he can. Laying off from left to right, he will find perhaps some streaks of rose colour and others of light and deeper yellow, but this, when dry, will be only natural.

The next colours will be either lemon or orange chrome, according to the depth of tint that it is wished to have at the horizon; if light, use lemon; if deep, use orange. Commence at the horizon line, working upwards, right across the scene. When about half way up towards the other yellow, dip the brush into lake, and a little white, still working up until the other tint is met. The sky is now all covered, but there are two distinct lines where the artist left off, and he has now to soften this all in—that is to say, to blend the colours together, forming a soft, flat, harmonious whole, the blue blending into the lakes and yellows of the horizon. This the artist will be able to manage after a little practice and perseverance.

To effect the blending, first wash all colour out of the stock-brush. When clean, dip the brush into clean water, but do not get too much water into it. Let the brush drain after lifting it out of the water, or squeeze it a little with the hand, because if too wet it will make the colours run, and spoil the effect.

The blending should be commenced where the blue and lake colours meet. I may here mention that in using the lake and yellow ochre, the lake should preponderate next the blue, the yellow ochre coming next, both tints of course being used with white, as stated above. By using the brush up and down, crossing and recrossing lightly, taking care not to disturb the colouring too much, the colours will be gradually softened one into the other. If well done, it will have a soft and beautiful effect when dry. The artist must be very quick with his work. After he has done the top blending he must treat the yellows from the horizon upwards the same way. To do this will be found somewhat difficult at first, but it will soon be mastered.

The artist should not attempt to paint in the sky unless he has time to finish it right off, so that the whole may dry together. When working on the other part of the scene, he may leave it as often as he likes; but not so with the sky. I have now said enough about the broad flat colouring of the sky.

Clouds.—The rubbing in and painting of clouds, so varied and beautiful in shape, ever shifting and never alike, assuming every form imaginable, will try the artist's skill. There are technical terms for different forms of clouds, such as *cumulus*—when clouds are heaped up in grand and striking masses—and many others; but these I need not enter on here, nor need the amateur scene painter trouble about them. Few colours are required besides what have been used on the flat surface, but as many gradations of those colours as possible will be needed. It is a good plan to dip one's brush into two or three colours—say, yellow ochre, lake, and white—and then to work it about in a broad manner. Should the artist wish his clouds to be massive and assume round forms, let him work his brush in the form he wishes the clouds to appear, but the colours must not be mixed too much, or they will be muddy. Supposing he wishes the clouds to be warm in tint, he would use more lake; if of a yellow cast, more yellow. If he wishes to have them very light he would use more white. For the high lights and edges of the clouds he must add more white to whatever colour he is using. If he dips his brush into the white last, and then commences at the top part of the clouds, working them into form as he works downwards, he will find when the work is dry that it will not be far wrong. Should the scenic artist not succeed in this most difficult part the first time—and he would be clever indeed if he did—perseverance will eventually overcome all his

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troubles. Sometimes sky and clouds may be rubbed in together, leaving a flat piece of blue here and there where it is wished to represent the flat sky. In this case the artist may work with two or more brushes, one being kept for the blue, the other for the white, yellow, lake, etc. He must work quickly, and lay on almost anyhow, and it will all dry up together, and present a result that is at once soft and harmonious. It will be soon seen why I recommend the painting in of the sky before leaving it to dry in one part before you go on with the other, for if the artist did otherwise he could not get the softness required by resorting to after-paintings—that is to say, by leaving the work, and finishing it at another time. When painting a glorious sunset, positive colours may sometimes be used with care; for instance, when the sun is low, streaks of vermilion, damp lake, the yellows, lemon, orange, etc., when swept across the sky with the brush, or stippled in, will have a charming effect. It must always be borne in mind that a good sky assists greatly in making a good picture.

CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL HAND.

CUCKOO CLOCK—MYSTERIOUS CLOCK—SEE-SAW CLOCK—CLOCK WITH NO VISIBLE WORKS—ELECTRIC ALARUM.

I AM now going to attempt to describe the mechanical arrangements of a few clocks that may doubtless have been at one time or another a source of wonderment to some of the readers of WORK. Although a "Practical Hand" at clockwork, I am not a practised writer, and if, in consequence, what I write does not seem perfectly clear, all I can do is to offer to explain myself in "Shop."

Cuckoo Clock.—As the hours and half-hours are struck on a gong of sweet tone, at each stroke the bird calls cuckoo. On giving warning, the bird slightly opens its door as if peeping; then, as the hour is complete, the lever drops, and the cuckoo throws the door open wide, opens its mouth, lifts up its wing and tail, and calls distinctly each time the gong is struck. When the number is complete the bird pops in and closes the door after it. Of course, some will say we know all about that well; but I have met hundreds that never saw a cuckoo clock. Now, how is it done? Very simply; when the lever falls from the hour pin, the striking part is set in motion, and an upright wire lever, with a very light brass wire coil spring around it to turn the bird in when calls are ended. This wire is turned one-fourth around by a small arm, which is held out by the stop lever when it is raised. In Fig. 1, A is an upright lever on which cuckoo, I, is fixed; B, light wire spring; C, small arm lifted by D and E, stop lever and arm; F is wheel acted upon by stop, which is connected to count wheel; G, bellows lifted on one side to produce "Cuc"; K, the arm at the wheel which also lifts hammer to strike the gong; J, connecting rod. At the other side a rather larger pair of bellows is affixed, and lifted same way by a longer arm, L, a little later than the arm K, so that it calls out "Coo," or "Koo." Those bellows simply blow down a small wood organ pipe, and the pipes are fixed in the side of the case of the clock, with a hole for the sound to come out. At the same time, the wire H lifts the bird's tail, and by an arrangement the bird opens its mouth, lifts its wings, and *seems* to call "Cuckoo"; M is the door it opens and closes with wire N. In taking the cuckoo to pieces, unscrew the four screws attached to the works and the case inside front; then, while face downwards, unfasten the wire from the door, and the hands having previously been taken off, the whole comes out at once. I am speaking of a cuckoo clock going with springs, not weights; if it has weights, undo the chain, hooks, etc. Now notice the sketch, and trace it all through; try it by striking it round, and you will see how the levers work, and the door is closed and opened, and the bellows arrangement. All else is like an ordinary round dial eight-day foreign clock. Clean all and examine as already described (see pages 580 and 665), and with a narrow strip of thin card or stout writing paper, clean away any dust or dirt in the lip or mouth of the two organ pipes, so as to have a full note; now put the going part together and try it, then add the striking ditto, and now replace the levers for cuckoo as per sketch (Fig. 1), and screw the plates together—foreigners beat us, in that we pin, but they screw, a better and safer plan—and hang it up on the wall without case to see that all moves right—bellows, levers, etc. After a few hours screw into case, test the

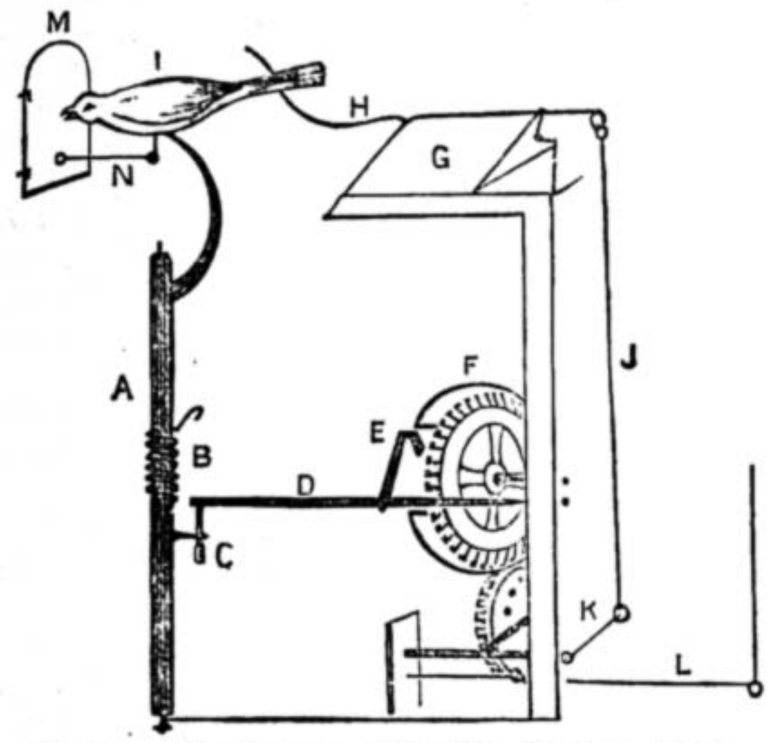

Fig. 1.—Mechanism of Bird in Cuckoo Clock.

cuckoo part, and replace the back with gong attached; turn over and fix the hands, and all is complete. It is not everyone who has served his time at the trade who can manage a cuckoo clock right. Any repairs treat as in other clocks, except such as the bellows. Leather may have holes in eaten by insect, etc.; if so, strip it off and lay it on an old white kid glove, cut to shape, and glue to original leather with thin glue. Any wires broken in cuckoo's body, wings, etc., you can easily imitate and fit. Use very *fine* wire.

Mysterious Clock.—This clock, with a lady holding the pendulum and swinging without any visible aid, used to greatly puzzle people. I think nearly everyone knows now how it is done. The figure stands on a plate very nearly balanced, and the slight impulse of each beat to the under side of the plate keeps the pendulum in motion. This you can easily see by fixing your eye on some article in the window behind the figure's head, and you will then perceive the oscillation. Clean and repair as for eight-day marble clock as described in page 666. There is the trumpeter clock, which works the same as the cuckoo, with pipe, etc. Also the sentry clock, where a small wooden soldier moves backwards and forwards. The figure is simply fixed on a lever, and the turning round is done by a notch which turns it. A man eating a dish of potatoes is manipulated by the figure having a striped waistcoat; one stripe is cut out, and inside the figure is a small wooden pulley, turned round by an endless thin leather band from a similar pulley fixed on a wheel in the movement. On the pulley inside his body is a wire, sufficiently long to revolve and just pass the fork held in the hand of the man. And notice this—the potato, on wire, *lifts* the fork and arm, which are fixed by a pin on the shoulder. The mouth opens just as the potato is leaving the fork

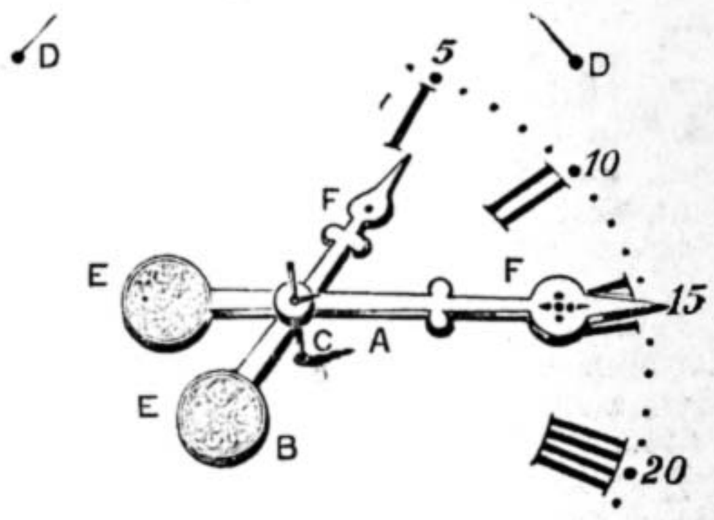

Fig. 2.—**Mechanism of Clock without Visible Works.**

and the arm, which drop to the dish again, waiting to be similarly lifted. The mouth closing upon the potato is done by a small piece of lead, which is fixed to the back of the chin to draw it up and close it.

See-Saw Clock.—This kind of clock, which never keeps time, is simply a small imitation branch of a tree. Two figures, one at each end, as John Bull and Uncle Sam, etc., are worked by the crutch of the pendulum placed upside down, and a small bullet, fixed on a wire in the centre of the branch out of sight, is moved to either side found out of balance; but the figures acting as pendulum through catching the air, etc., keep bad time. Next is the clock with the ball and string, which, in trying to revolve, has to pin a few turns around a wire at each side. This is useless, being a worse timekeeper than the above. Those with a sweet-looking child swinging backwards and forwards instead of a pendulum ball, and a small boy standing at one side, whose arm lifts to a small cord as if he kept her in motion, are very neat American made clocks.

Clock with no Visible Works.—The mysterious clock or timepiece, with no visible works, and a glass dial showing only the hands, is very clever. I once made one for a

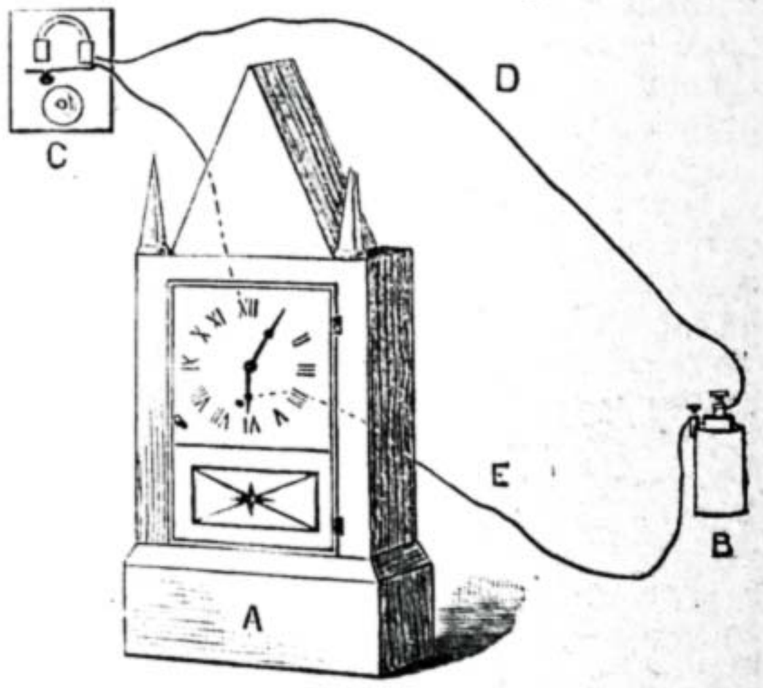

Fig. 3.—**Electric Alarum Clock.**

shop window as follows:—Take a square of stout glass, 16 in. by 14 in., and drill a hole in the centre using plenty of turpentine, and in a quarter of an hour you will be through. Now take a *stout* darning-needle, best quality, and fix it in the hole at the back with transparent cement, leaving about an inch and a half of the needle with the eye to the front. Paste

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on the glass Roman numerals or figures, cut out of gilt or white paper. You can mark the places on whiting under side; put small dots for the minutes. Now make two thin metal hands as in Fig 2, in which A is the minute hand; B, hour hand; C, needle stud on which they turn; D D, cord to suspend dial plate. Now, after making them the right length for your circle of dial, solder a rim on behind each hand at E, E, to hold the movement of a Geneva watch, which you can procure where they melt up cases in large towns at 1s., 1s. 6d., and 2s. each. Pick those that will keep going whichever way you turn. Now fit one into each end at E, with hole to wind up, very small, not to be noticed; engrave about it to hide it. Now on to the barrel which held the hour hand, which you have fixed to B, place a small lead weight, shaped as at G, on to a watch hand, and fix it as if a hand, long enough to just turn easily within the rim of E. Do the same with the other, but place it upon the minute hand, for it has to go round the dial in one hour. Now, at F on the under side, solder a piece of lead just heavy enough to make either hand balance *true* at three o'clock or nine o'clock; then, when perfectly even, wind up, and the minute hand will commence to move. As the small weight is trying to rise, it adds its trifle of weight to the extended end, and consequently causes the other end to move on. And now the only thing is to regulate the movement as when it was a watch, and it will keep good time—mine does. Now do the same to the hour hand. Of course its weight moves slowly, so does the whole hand; regulate it to do in twelve hours in unison; it must be set to time with the other. To commence, simply turn centre square, as when a watch; that turns the small weight, and so balances it at the right time you desire. You then only need wind every day, and surely that small trouble is nothing for the pleasure of astonishing your friends. The movements have very little more to do than when carrying the hands, for at the least rise of the lead weight the large hand moves and eases it again. Mine will actually turn the weights round if I fix the whole hand. Make one: it will only cost you, say, 4s.

Electric Alarum.—Next I made an electric alarum, but I am no hand at battery filling, etc. This I got done by a telegraph manipulator for one shilling—filling, putting to work, etc.—and it acts twelve months without attention, being a Leclanché, one large cell. To an ordinary Gothic bedroom timepiece I fixed a short stud near the numeral VI. (see Fig. 3), to project out only so much that the hour hand *just* touches it and no more, then passes on. This you can easily manage, as the dial is only zinc, and can be put any distance and fixed; but you must have a glass bead to pass through, so as not to touch the zinc. The E wire must fix to the stud inside the clock, and the other wire must rest on the axle of the hour hand, so that at six o'clock, or at what hour you place the stud, when the hour arrives and the hand touches it the bell rings and does not cease until you rise and stop it, so as not to waste power. A is the clock, say 5s., 6s., or 7s. 6d.; B, the Leclanché battery, anywhere out of sight; C is the bell; D and E, the positive and negative wires. The alarum is easy, and its total cost, even with assistance, will not be more than, say, 5s.

With another paper I shall bring my remarks on the subject of clock cleaning and clock repairing to an end. They have been addressed to amateurs chiefly.

MODEL ELECTRIC LIGHTS.

BY GEORGE EDWINSON BONNEY.

SPINDLE OR SHAFT FOR GRAMME ARMATURE—COMMUTATOR—WINDING GRAMME ARMATURE—BRUSH HOLDERS AND BRUSHES—WINDING THE FIELD MAGNETS.

The Spindle or Shaft for the Gramme Armature.—Before we set about preparing the spindle for the armature, it will be advisable to fit the bearings in their places in the standards. These will be fitted in the lower part of the crosses in the standards; the cross-slit receives an iron plate, fixed in with wedges, to hold the bearings down, and the upper part of the cross forms a space for the lubricator. The stem of this lubricator is screwed to fit a hole in the wedge-plate, and the oil is conducted through a hole in the upper half of the bearings. When these are turned true, and fixed, we will turn our attention to the spindle.

The shaft, or spindle, for the armature should be made of mild steel, of a size and length suitable to the machine in hand. It may be forged or turned to the shape shown at Fig. 46, which shows the form generally suitable to this machine. Referring to the figure, the long spindle end from A to B will go into the left-hand bearing of the machine, shown at Fig. 39 (page 677), and form a spindle for the driving pulley. The two shoulders B and C are for the bearing and the boss of the armature spider respectively: at *d* and *e* two holes must be drilled through the shaft and fitted with clutch-pins, to coincide with the two key-ways left in the spiders, and thus prevent the armature from turning round on the spindle. The space between *e* and the screwed part at S will be occupied by the commutator, and the remainder of the spindle will be taken up by the right-hand bearing. Quite two inches of the spindle at S should have a thread chased upon it, and a hexagonal nut fitted on the thread to bring the commutator and the spiders of the armature in close contact with each other. The spindle being prepared, we may next mount the armature on it, and, having put the spindle into its place, turn it round to see that every part runs true, as now will be the time to make any alteration required. This done, go all over the armature, armed with a half-inch square file, and trim off any roughness which may appear on the cogs and in their spaces, so as to bring the whole into one smooth and solid-looking mass. If the cogs do not properly clear the pole pieces, the projecting parts may be trimmed off in a lathe. The spaces between the cogs should now be coated with varnish and set aside to dry, preparatory to being wound with wire.

The Commutator.—The commutator or collecting cylinder of the Gramme machine, differs from that of the Siemens machine in that it is furnished with several segments, corresponding in number with the coils on the armature. Fig. 47 gives a general idea of its appearance when finished, whilst Figs. 48 and 49 show how it is constructed. The first thing to get is a piece of well-seasoned boxwood, large enough to turn out a solid hub of not less than 2 in. in depth and 3 in. in diameter. This hub must then be bored with a hole in the centre to exactly fit the armature spindle. On this cylinder of boxwood is mounted the bars of the commutator, as shown in Fig. 47. It would be possible to cut out these bars one by one from a sheet of hard brass, and fit each to the outside of the cylinder; but the commutators of small dynamos may be built up by a more convenient and accurate method. Procure a piece of gun-metal tube, with sides quite $\frac{1}{4}$ in. in thickness, and a diameter large enough to go over the boxwood hub, when a slight cut has been taken from the inside to render it smooth. Cut off a piece long enough to cover the hub, and fit this gun-metal ring tightly on to it. Now divide the ring into as many equal size sections as there are cogs on the armature. If there are ten cogs we must have ten sections, if fourteen cogs we must have fourteen sections, but each section must be equal, so as to form a series of equal-sized bars all round the hub. The division lines should be deeply scribed with a sharp steel scriber, then nicked with a hack-saw, as shown at Fig. 48. Next drill a small hole through each end of each section and into the hub beneath; countersink the mouth of each hole, and drive a short brass screw into each, as shown in Fig. 48. This done all round, next cut each section free from its neighbour, and allow the saw to enter the boxwood hub below, to the depth of nearly $\frac{1}{4}$ in., to form a hold for the insulating substance to be placed between each section. The insulating substance may be vulcanised fibre, or asbestos millboard. Procure some sheet fibre, or millboard, a trifle thicker than the saw-cut divisions, and cut from it slips large enough to exactly fill the cuts, as shown by the thick black lines at Fig. 49. Slightly ease the screws of each section, wedge the prepared insulating strips firmly into each saw-cut, then tighten the screws again, and so pinch each strip tightly between the edges of the sections on each side. When this is done, mount the hub in a lathe, and true up all rough projecting parts with a sharp tool, or with a rough file at first, and then with a smoother file.

As each segment of the commutator will have to be connected to the ends of two coils of wire, we must now furnish each with a means of making the connection. This is best done in the following manner:—Select one end of the commutator to go next the armature (it matters little which end), then drill a $\frac{1}{16}$ in. hole in the extreme end of each section, and tap each hole to receive a screw. Next take a length of No. 12 B.W.G. hard copper wire, and cut up into two-inch lengths. Flatten one end of each length as shown at Fig. 51, and screw the other ends to go into the tapped holes made to receive them. Tin the screwed ends of each connector with a soldering-bit, and screw them as they are done into their places, giving each a touch with the soldering-bit to make the solder run, and fix the connector firmly in its place.

A disc of vulcanised fibre, slightly larger in diameter than that of the commutator, should now be turned out of a piece of $\frac{1}{4}$ in. sheet fibre, and this must be placed between the end of the commutator and the arms of the armature spider, to ensure the complete insulation of the one from the other when they are tightened up together on the spindle.

Winding the Gramme Armature.—Presuming now that we have the armature ready for winding, we will set about the job of winding on the wire for its coils. Before we do this, however, we must calculate how much wire will be needed for the whole number of coils, and divide this quantity equally among them all, so as to ensure each coil having the same resistance. In a table given with this paper (page 726), I give the proportions required for each size of armature. Looking down this table, we shall see that only three sizes are used: namely,

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16, 20, and 22. If we remember that No. 16 cotton-covered copper wire runs to 24 yards in the lb., No. 20 runs 80 yards in the lb., and No. 22 runs 120 yards in the lb., we can easily calculate the length of wire for each coil by multiplying the number of yards per lb. by the number of lbs. to be used, and dividing this by the number of coils to be placed on the armature. For instance, supposing we have to use 4 lbs. of No. 20 on an armature having 10 divisions :—4 lbs. × 80 yards = 320 yards ; and this, divided by 10 (the number of divisions), will give 32 yards to each division. Measure off the length for each coil on a yard measure, marked on the work-bench, and roll the wire up into small hanks, containing one coil in each hank. Place each hank in an old meat-tin, or similar vessel, containing melted paraffin, kept hot the while, and let it soak therein for several minutes, then hang up to drain dry. Next make a wooden shuttle to the shape shown at Fig. 52 out of some tough hard wood. This shuttle may be from 9 in. in length, and of a width suitable to the size of the spaces through which it has to pass ; the gaps in the ends must also be cut to a size large enough to take the whole coil of wire, and this will vary with the size of the armature to be wound. The shuttle for the smallest on the annexed list should be 9 in. × 1 in. × ½ in., with gaps ¾ in. deep by ⅝ in. in width. All edges must be rounded and made quite smooth, to prevent chafing of the wire covering whilst the coil is being wound. This shuttle must now be neatly wound with one of the coils of wire, and then we are ready for winding the armature.

This is a two-handed job, and it is necessary to secure the services of a mate to help us whilst doing it. The armature ring may be held on a low trestle between the winder and his mate. Examine the edges of the spaces between the cogs and inside the ring, to detect any rough places likely to abrade the wire covering. If any of these appear, do not file them down, for in so doing the dried coat of shellac varnish would be injured, but cover them with short pieces of broad tape, well soaked in hot paraffin. Begin winding on the left-hand side of one of the spaces, next an arm of the spider. Wrap a few turns of the outside end of the wire around the arm of the spider, just to hold it in its place, pass the shuttle to the assistant over the armature, and get him to pass it back under the ring ; lay the coil up close to the left-hand cog, and draw it moderately tight, then pass the shuttle over again to the assistant, who will return it under as before. Thus proceed, laying each coil closely side by side, until the space between the two cogs has been covered. Then wind back from right to left until the first layer of coils has been closely and regularly covered with another layer. If using a large wire, such as No. 20 or No. 16, the winder will perceive a tendency on the part of each coil to bulge in the centre of the space. This bulging must be kept down from the first by gently tapping the bulging part (whilst tightening the coil) with a small wooden mallet, or by placing a piece of wood on the wire, and striking it with a hammer. The wire must be kept down level and compact in the outside space, but the inside may be disregarded. Whilst winding the coil, test it frequently for insulation by the method given in my last paper, and make good each faulty spot before going on further, for leakage here will destroy the efficiency of the machine. When the first coil has been wound, fasten down the last piece of wire (which should end on the opposite side of the winding space, and be long enough to reach the commutator), and coat the outside of the coil with some quick-drying varnish. Remove the guiding pieces of wood, which have been shown in Fig. 45, page 677, and paint the inside coils with varnish in a similar manner. This will help to set the wire in its proper position, and

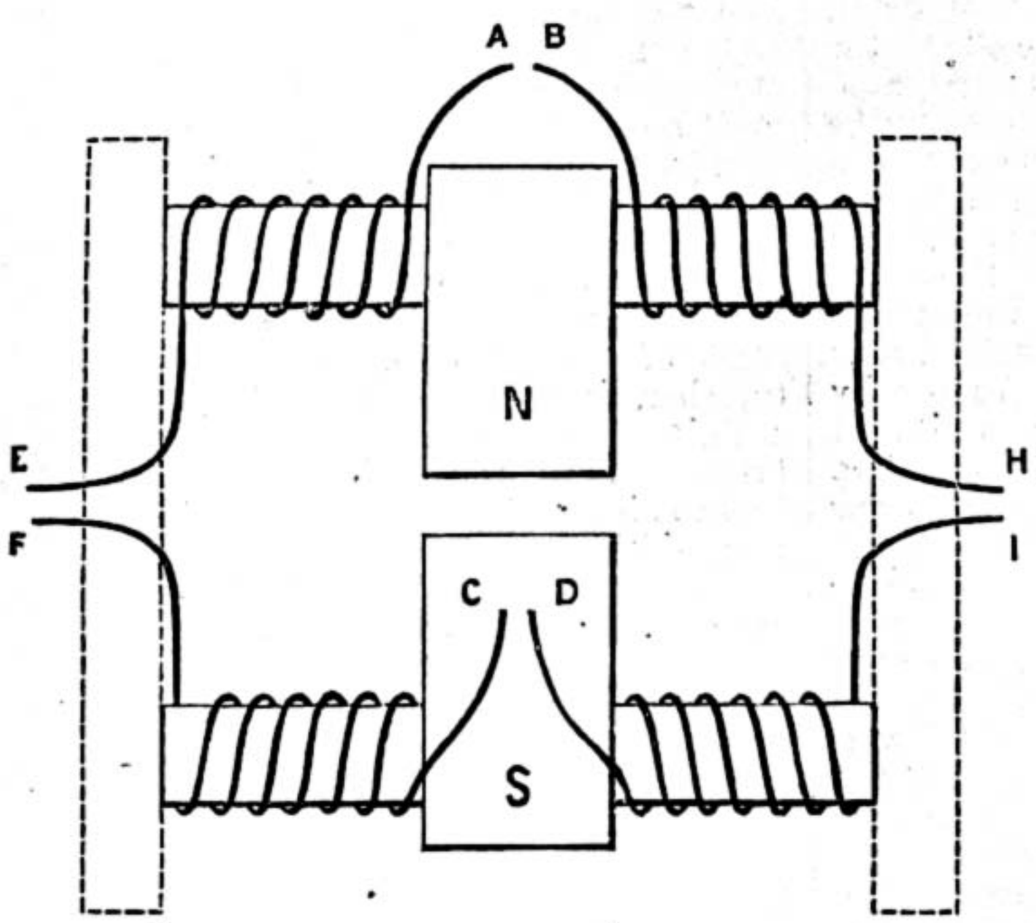

Fig. 56.

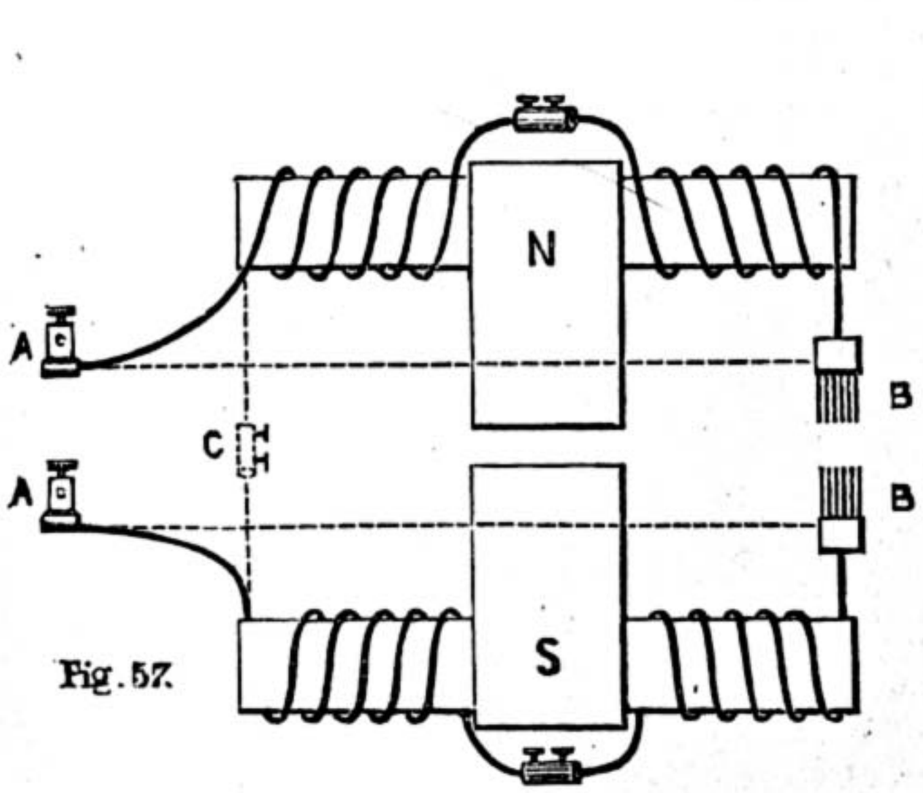

Fig. 57.

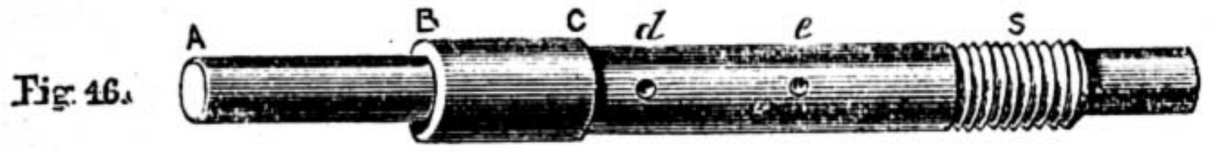

Fig. 46.

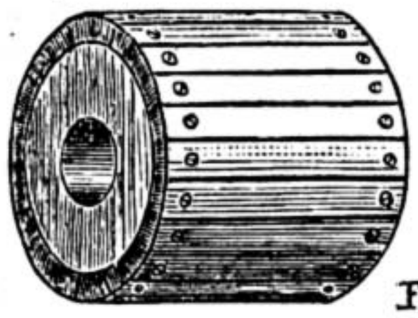
Fig. 47.

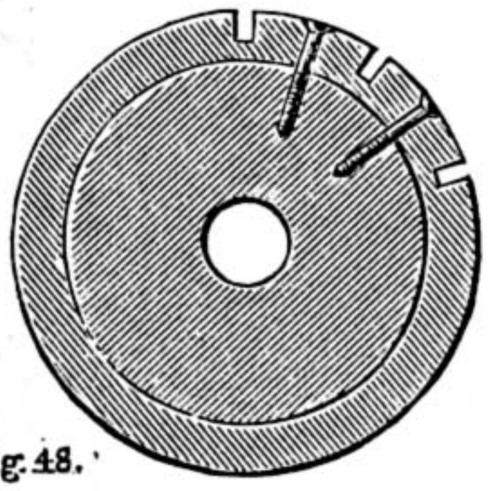
Fig. 48.

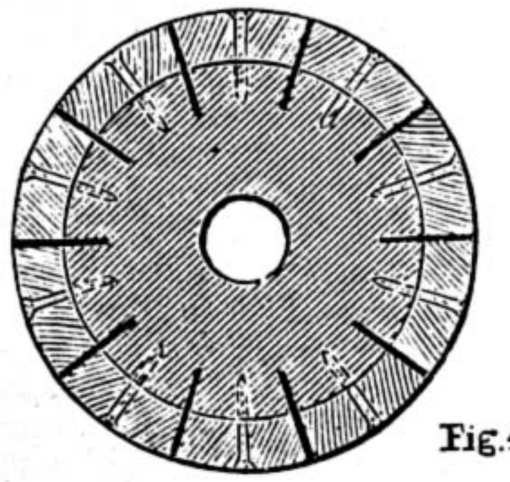
Fig. 49.

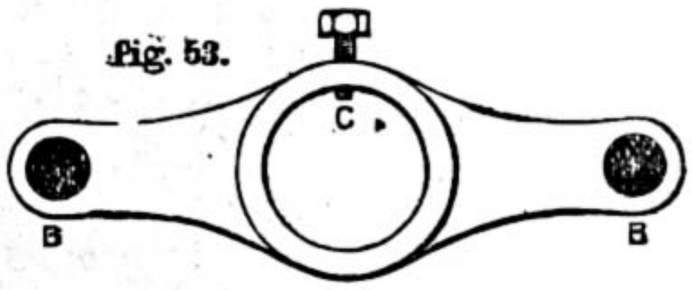

Fig. 53.

Fig. 52.

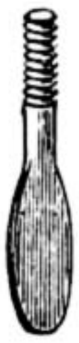
Fig. 51.

Fig. 51A.

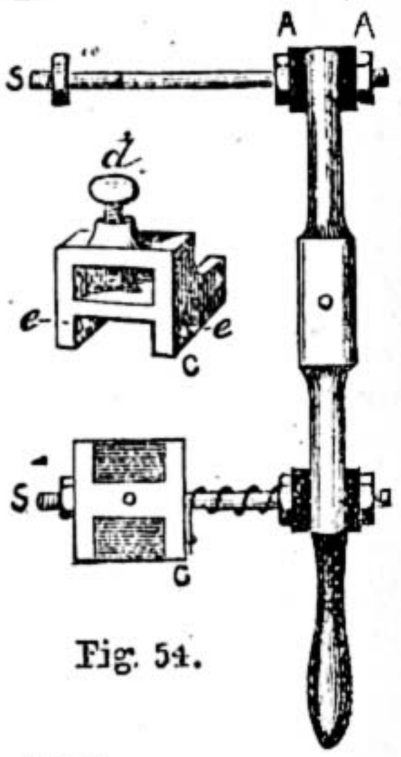

Fig. 54.

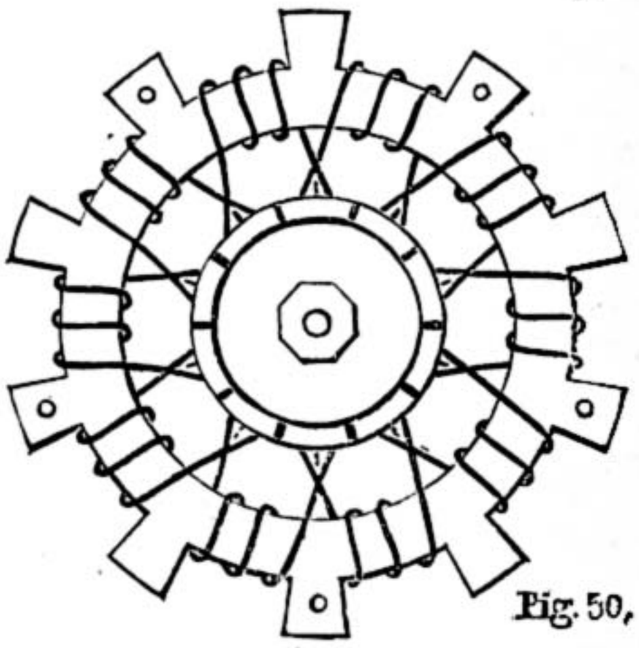
Fig. 50.

Fig. 55.

Fig. 46.—Spindle of Gramme Armature. Fig. 47.—Commutator complete. Fig. 48.—Diagram showing how to divide Commutator Ring. Fig. 49.—How to insulate Commutator Bore. Fig. 50.—How to connect Armature Coils to Commutator. Fig. 51.—Copper Connector for Ends of Coils. Fig. 51 A.—Ends of Coils twisted together. Fig. 52.—Winding Shuttle. Fig. 53.—Rocker for Brush Holder. Fig. 54.—Brush Holder and Parts complete. Fig. 55.—Section of Clamp or Brush Holder. Fig. 56.—Diagram showing how to wind Fields of Gramme Dynamo. Fig. 57.—Diagram showing how to connect Fields in Series and in Shunt.

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also secure more perfect insulation of one coil from the other. Go on thus with each coil until all the spaces have been filled. It will then be well to examine each coil, and see that no part of it bulges above the level of the cogs; if this happens, the bulging part must be beaten down level with a wooden mallet. The whole wire should now receive one or two coats of varnish, the commencing end of each coil being also painted with a distinctive colour to facilitate its recognition when connecting the ends to the commutator bars.

When the varnish is dry and hard, the armature may be mounted on the spindle. The commutator must next be forced on tight in its place, and the two fixed closely together by screwing up tightly the nuts on the chased end of the spindle. It is well here to have two nuts, one to lock the other, and prevent those parts from shaking loose. The coils may now be connected to the commutator bars by soldering the commencing end of one coil and the finish end of its neighbour to its connector, as shown at Fig. 50. It will be found convenient to bare the ends of the wires, and clean them, then twist the end of one coil round the commencement of another, so as to form a clip on each side of the connector, as shown at Fig. 51 A, and tin this with the soldering-bit before soldering to the connector.

When a small armature is tightly wound with fine wire, and this is coated with some two or three coats of varnish, the coils should hold well together. But there is always a danger of disruption, owing to the immense strain from centrifugal force, when coils are whirled round at the rate of from 2,000 to 3,000 revolutions per minute. This has a tendency to throw a wire out here and there, with most disastrous consequences, when the coils are arranged to revolve close to cast iron. It will be well, therefore, to bind the middle of the armature coils with several coils of tarred tape, so as to form a hoop, and to wind tightly over this several strands of No. 24 phosphor-bronze wire, side by side, to form a hoop about ½ in. in width. The ends of the wire must be twisted together and soldered, using resin only as a flux; and it will also be advisable to solder the whole wires together here and there, where they pass over the cogs of the armature.

Brush Holders and Brushes.—The brush holders for this class of machine are not fixed to the bearings or to the pillars, as in the small Siemens machine, but they are made in the form of a "rocker," pivoted on a bridge attached to one of the standards, as shown at Fig. 41 (page 677), and therefore free to be moved round the commutator as desired. The "rocker" is a malleable iron casting, shaped as shown at Fig. 53. The large hole in the centre is turned to fit loosely on the hub of the bridge shown at Fig. 41. A hole is drilled and tapped in the crown of the arch C to receive a set-screw used in fixing the rocker in any required position. Two ½ in. holes are then drilled through the ends, and these holes are then plugged with ebonite, as shown at Fig. 53, B, B. In each of these a ¼ in. hole is drilled, to receive the screwed ends of the spindles (Fig. 54, S, S), on which the brush clamps C, C, are hung. The spindles may be made out of ⅜ in. brass rod, cut long enough to bring the outer ends within ¼ in. of the inner edge of commutator. The inner ends—to go in the ebonite plugs on the rocker—must be turned down, and screwed to take two hexagonal nuts, one each side of the rocker, as shown at A, A, Fig. 54. These must be insulated from the rocker by two washers of ebonite or of vulcanised fibre. On the opposite ends of the spindles must be fitted two other hexagonal nuts, to keep the brush clamps from coming off. These clamps are made of gun-metal, shaped as shown in Fig. 55. The upper part of this clamp is made to receive the strips of hard brass, copper gauze, phosphor bronze, or whatever material may be chosen for the brushes. In this part the strips are held by a brass plate placed on top of them, and secured by the thumb-screw *d*. Holes are bored for the spindle to pass through the lower part, as shown at *e*, *e*. The clamp is thus free to move around the spindle, and this freedom of movement, together with that of the rocker, allows the brushes to be adjusted to any required angle. A small brass staple soldered to the inside of each clamp receives the end of a spiral spring threaded on the spindle, and this ensures due pressure of the brushes on the commutator, whilst it also keeps the clamp in its proper position at the end of the spindle. In adjusting the brushes, it is found advisable to move the rocker by means of an insulated handle, made of ebonite or vulcanite. This is shown in Fig. 54. It may be fixed to the rocker by means of a ¼ in. bolt screwed into the end of the rocker. A similar handle may be fixed at the other end if so desired.

Winding the Field Magnets.—As the wire for the field magnets of a Gramme machine will be wound in four separate coils, it will be advisable to divide the total quantity of wire to be used in these coils into four equal parts, and to treat each part as recommended in the treatment of the wire for the armature. After each coil of wire has been soaked in paraffin-wax, it should be wound on a stout wooden bobbin, as it will be easier run off from a bobbin on to the magnet core than from a hank. The method of winding, so as to secure a north pole piece above the armature and a south pole piece below the armature, is shown at Fig. 56. Mount the core to be wound in a lathe. and put on the back gear slow speed. Suppose we wish to wind the first cores to give a north polarity to the pole piece. Commence by twisting one end of the wire A round the neighbouring core, cross it over the pole piece, take one turn round its own core, and tie this turn with a short piece of twine. Then proceed to wind on the wire evenly and regularly, with the coils close side by side, from the pole piece on the right to the end of the core at the left, to and fro, until all the wire has been wound on; then tie the last coils together tightly with a piece of narrow tape, to prevent them from springing back loose when the end E is free. Next unfasten A from the right-hand core, and commence winding on the next coil, beginning at B and winding from left to right, observing the same precautions as in the first coil, finishing off the opposite end at H. Next, wind the cores for the lower pole piece, commencing each at C and D respectively, and finishing off at F and I. If the machine is to be connected in series, the two ends, E and F, will now be led to the two terminal binding screws, and the two ends, H and I, to the two brushes: whilst A and B will be coupled together, and also C and D connected to each other by screw connectors. If the machine is to be connected in shunt, the two ends, E and F, will also be connected together to form a continuous coil from H to I. These two only will be connected to the brushes, and from the brushes will go two short pieces of wire to the terminal binding screws of the machine. The distinction is shown more clearly in Fig. 57. When the two finish ends of the left-hand coils are connected to the two terminals A, A, and the two finish ends of the right-hand coils are connected to the brushes B, B, the circuit can only be completed by placing some kind of work in series with the coils between the terminals. But when the two ends of the left-hand coils are coupled up together, as shown at C, and the brushes are connected with the terminals, as shown by the dotted lines, the current is shunted through the coils, and the cores are always magnetised ready for action. This last condition always assumes that the cores are magnetised at the first, and thus are furnished with an initial amount of magnetism. This initial charge must be given to them by a battery sending a current through the coils, as explained in my last chapter on this subject.

The various parts of the machine may now be put together or fitted to each other. The field magnet coils should have two or three coats of varnish to set the coils of wire together, and to give the whole machine a finished appearance. In adjusting the brushes, move the rocker until the best position is found by actual trial. The indication of this is—a full current at the terminals, very little noise at the brushes, and little or no sparking where the brushes touch the bars of the commutator.

It will be noted that I have not given the sizes of the various parts. This I could not do in dealing with the subject as I have done: namely, in a general manner, applicable to several sizes of machines. All parts are, however, made proportionate to the size of the castings, and the vendor of these will also supply the various parts in the rough at a less cost to the amateur than that incurred by him if he made his own patterns and had the parts cast to order. I give below a list of Gramme machines made and sold by Mr. S. R. Bottone, Carshalton, Surrey. From this list the amateur can choose his machine, and can also see at a glance the dimensions of its various parts.

TABLE OF GRAMME DYNAMO-ELECTRIC MACHINES.

No.	*Cores. 4.*	*Cogged Armature.*	*Wire on F.M.'s.*
	Inches.	Diam. Deep.	
1	1½×2	3½ in. ×2 in.	6 lbs. 22 d.c.c.
2	2×3¼	4⅞ in. ×2½ in.	10 lbs. 22 d.c.c.
3	3×6	6 in. ×6 in.	20 lbs. 20 d.c.c.
4	4×7	7 in. ×10 in.	90 lbs. 16 d.c.c.

No.	*Wire on Armature.*	*Speed per min.*	*Power Developed.*		
			C.P.	Amps.	Volts.
1	1½ lbs. 22	2,500	50	5	25
2	4 lbs. 20	2,000	100	5	50
3	4 lbs. 16	1,500	200	10	55
4	12 lbs. 16	1,200	600	30	55

Machine No. 1 has a solid-cogged armature, but all the others are built up of cogged laminated plates. In winding the armature of No. 4, two strands of No. 16 are used, side by side, to reduce resistance in the armature coils. All these machines are made to work incandescent lamps only.

In writing the foregoing description of the various parts of the Gramme dynamo, I have been much aided by a perusal of a little book on "How to Make a Dynamo," written and published by Mr. Alfred Crofts, of Dover. I can heartily recommend this book to all of my readers who may wish to make a small Gramme machine, and would like to make all the parts themselves. Mr. Crofts only describes one size of the Gramme

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dynamo—one capable of giving a current of 8 ampères at a pressure of 45 volts—but he has done this in a most thorough manner, by using a style easily understood and a number of clearly drawn illustrations. The author has practically worked out the machine for himself, and is open to supply amateurs with all requisites necessary to make a Gramme machine.

A PEDESTAL FOR BUST OR LAMP.

BY C. E. MAES.

THE pedestal shown in the accompanying illustration is by no means difficult to construct, and when made, will form withal a pleasing addition to the somewhat limited number of articles which may be placed conveniently in the corner of a room. As a support for busts or vases, similar pedestals are well known; but the idea that they may be used as lamp-stands is possibly a novel one to some readers, and may require explanation. Few, however, can have failed to notice the tall metal lamps which have become so fashionable of late—that is to say, the lamps which have a high stand, rendering them independent of any table. These stands are usually of metal, and more or less costly articles of luxury. Why should the metal worker have it all his own way with these things, to the exclusion of the wood-worker? A wooden pedestal is surely as suitable as one of brass, and, what is equally to the purpose for home workers, it can be more readily made. However, the object of this short paper is not so much to suggest what the pedestal may be used for as to tell how to make it; and if any apology for giving instructions on such a simple matter is required, let me just say that a certain individual wanted to make a pedestal similar to that shown. It was to be at least 5 ft. high, and the lathe would only take 3 ft. long. This is a fair length between centres for an ordinary amateurs' lathe, and possibly others besides the individual referred to may be inclined to wonder if the job could be managed. It certainly can be by the very simple means of turning the pedestal in separate pieces, and fastening them together afterwards.

When this has been said, very likely all the description that is necessary to enable skilled workers to make the pedestal has been given, but others may require a few more hints to enable them to set about and complete it without tentative efforts. As will be surmised, the pedestal is turners' work, and as we proceed, it will be found that the whole of it can be turned up in a lathe which will take 3 ft. between centres, provided these are not less than 5 in. from the bed. If the centres are a little higher, it will be all the better, as the diameter of the largest member of the column is 9½ in. Anyone who has such a lathe as, say, the Britannia Company's No. 10, should experience no great difficulty in turning even this size. It is not, however, my intention to describe the operations of turning, as it may fairly be presumed that the possessor of a lathe will have some idea how to use it before attempting such large work as that involved in the pedestal. It is not a suitable thing for the beginner, for though plain and simple—or, perhaps, rather because it is so—the turning should be accurate, not necessarily to sections and sizes given, but to whatever others may be preferred. Those given are from a model before me, and may be taken as fairly typical of the style of a plain pedestal, which, it may be said, is often more pleasing than a highly elaborated outline. That, however, is a matter on which opinions may differ, so nothing more need be said about it; but whatever the design, there can hardly be two opinions about the propriety of setting the work out full size. When this is done, calipers and rule will enable correct sizes to be turned in the lathe. For those who wish to work closely to the design shown, it may be said that Figs. 2 and 3 are given one-third full size. The former represents the members above the long centre column, the latter those at the bottom. On comparing them with Fig. 1, this will be clear, and show their relative positions without any chance of misapprehension. To economise space, only half of each part is shown. Between each member on Figs. 2 and 3, it will be seen a space is left, in order that the separate turned parts may be more readily distinguished. It may be thought that if the long centre column can be turned in one piece, the shorter ornamental ends might also each consist of one piece. Those who prefer this style of construction may certainly adopt it; but before they do so, they may as well consider the amount of turning required merely to cut away the waste wood. Thus, in the top part we find that the greatest diameter is 8 in., and the smallest only 4½ in. Is it worth while to turn down a piece 8 in. thick? If the object were to make shavings, it would be; but as the object is to make a pedestal, there is no reason for wasting either time or material on superfluous labour. Let each piece be turned out of a piece of board of the required thickness, when, if the wood has been previously trued-up with the plane, only the rim will require turning. No special remark need be made about the preparation of the wood for these parts, but the main portion of the pedestal cannot be thus lightly passed over. At the top it is about 5 in. in diameter, and at the bottom an inch more. Now, to get a nice sound piece of wood free from knots or shakes may not be always an easy matter—at least, not so easy as getting several pieces of smaller dimensions without faults. These can easily be built up to make one solid block, which will be more satisfactory than a single piece—unless, indeed, the pedestal is to be polished in its natural colour, whatever that may be, when the joints might be unpleasantly conspicuous. I assume, however, that the pedestal will be made of some soft wood, and either ebonised or finished with an enamel paint, which will conceal the joints. Some, however, may prefer oak, walnut, or mahogany in their natural colours, and merely French polished; and in that case it will certainly be better—if a suitable piece can be got—not to build up the main portion of the pedestal, but to use one piece for it. Should there be any cracks, they may be filled up by "splintering" if of any extent, or with some stopping if small. The former consists of gluing slips of wood into the shakes, and afterwards trimming them off. It will be advisable not to "splinter up" till the turning is done. If, from any cause, it should be necessary to build up for the column in any wood to be unpainted, it will be as well to do so from four squares only, and not from planks, so that the joints may be as few as possible. It seems hardly necessary to say anything more about this part of the work, but in case the notion is not grasped, Fig. 4, showing the section of a column (when turned) formed from four pieces, and Fig. 5, the same, made up of boards, are given. Glue alone will hold the pieces together, but let the joints be as good as possible; and it is, perhaps, superfluous to say that the glue must be hard before the wood is put in the lathe. Each of the discs should have a hole bored exactly through its centre,

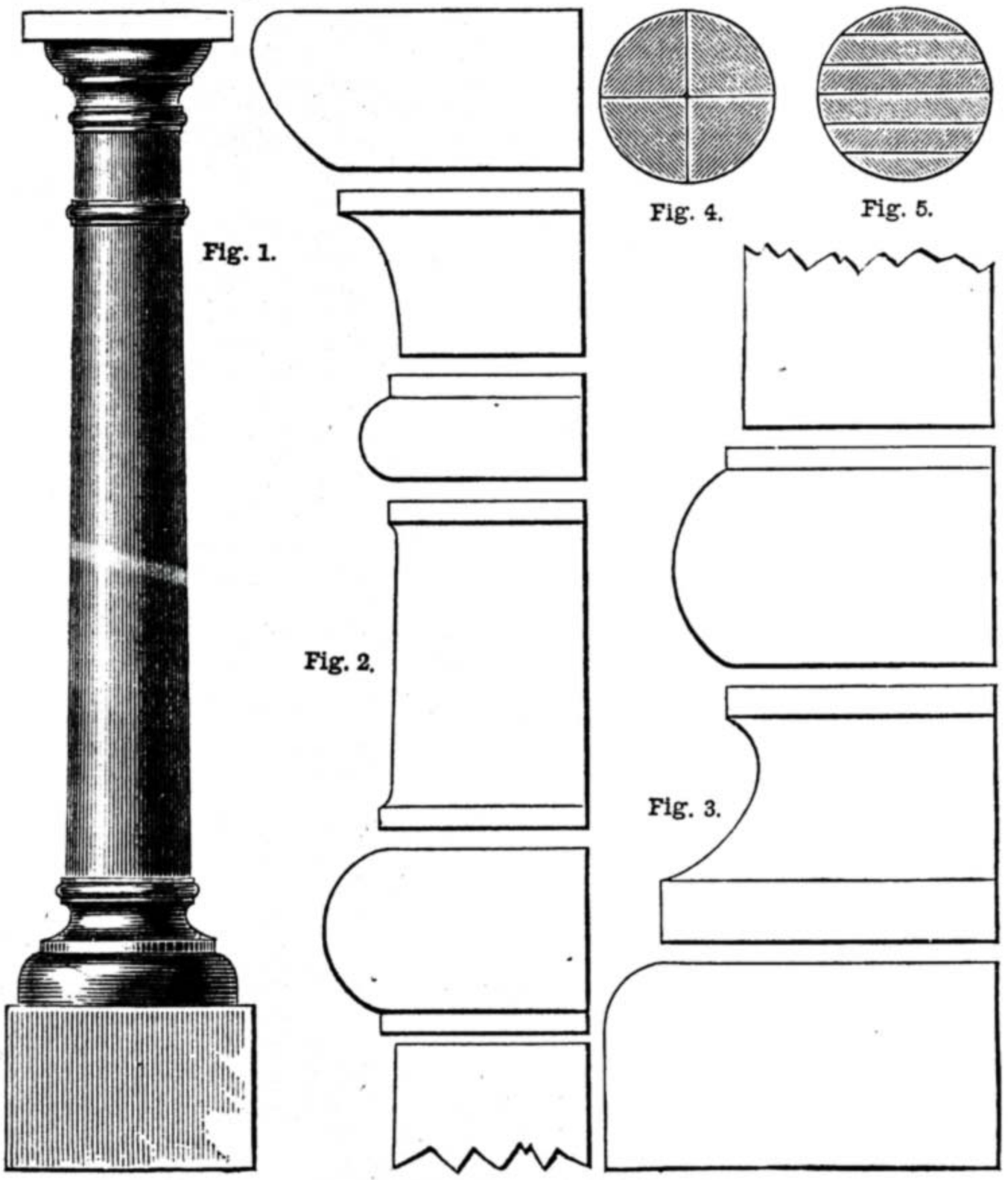

Fig. 1.—Pedestal. Fig. 2.—Upper Part (one-third full size). Fig. 3.—Lower Part: ditto. Fig. 4.—Column built up of Four Pieces. Fig. 5.—Column built up with Boards.

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through which will run an iron rod fixed into the end of the long column. Probably many will find a wooden rod more workable, and if so, it may be used instead. It should scarcely be less than 1 in. thick, and of some good tough wood, such as ash, but so much will depend on the way in which the discs are fastened to each other that a good deal must be left to the discretion of the worker. The rod, or rods—for there must be one to each end of the column—may even be dispensed with altogether, but their use will be found of service in getting each disc evenly placed, as it will be only necessary to slip them on like so many rings. The centre sticks, or rods, should be rather longer than they will be afterwards, when the pedestal is completed. The end of the upper one can be cut off flush when the capping is put on, and any projection of that at the bottom will be concealed by the plinth. The rods must be well glued into the column. Before finally fastening all the parts together, it will be well just to see if they all fit. If the centre rod is sufficiently strong, further fastening of the parts together will be unnecessary; but if there is any doubt about it being so, it will be well to avoid all risk by either gluing or screwing each part to the one next it. A couple of stout screws to connect each disc will be sufficient, especially if they are only used as auxiliary to glue. Dowels are sometimes used instead of screws, but for amateur workers screws will probably be more convenient. It will be understood that these directions, if they can be so called, are given rather as hints and suggestions for the worker to act on according to the means at his command than as hard-and-fast rules from which there can be no departure without detriment to the pedestal. They are general directions, having special regard to the work in hand, but they may also be applicable to many other contrivances, and on that account are perhaps not unworthy of being regarded as educational. Though it might be easier for the pedestal maker to have definite directions about all parts of the work, the great end and aim of such a magazine as ours is not, I take it, merely to say how any given thing may be made, but to educate—the word being used in its literal sense—our mechanical and inventive faculties, and by so doing, advance technical education, if not so noisily, at any rate more effectually than by "talkee talkee." Parrots are good at this sometimes, and, no doubt, could talk quite as intelligently as some of the good people who, though enthusiastic, know very little about the needs or difficulties of the practical worker who is to be "technically" educated. But this is a slight digression, just while the glue is setting—one of those pleasant little interludes which relieve the monotony of constant work.

The top of the pedestal is simply a piece of thick board, say, 1½ in. to 2 in. stuff. It may have a hole in the centre for the rod to pass through, the rod, if wood, being split and wedged up, much in the same way that hammer-heads are often fastened to the handles, and it may be further secured by two or three screws. The other end of the pedestal may be similar to the top, but it will add dignity to the pedestal if it is more as shown in Fig. 1. To have it solid would be inconvenient in most instances, and a box-like construction will do very well. It is not always considered necessary to weight the bottom of such a pedestal, but it is safer to do so with a comparatively light one. Much, however, depends on the position the pedestal is to occupy. If it is exposed and likely to be knocked over, by all means put some "ballast" at the bottom; but if it is in an out-of-the-way corner, none may be required. What the weighting will consist of must be left entirely to the maker, and also the quantity. A few pounds of lead nailed to the bottom of the plinth inside may be named as appropriate, but any scraps may be made available by fastening them to a board, and nailing this on as a bottom beneath the plinth. Perhaps a few suggestions should be given about finishing and further adorning the pedestal. First, then, if it is to be French polished, let the polishing be done in the lathe, or, if that is not convenient, polish the various parts before they are fitted together. The polishing will be much cleaner than if it were done after the pedestal is together, when it should only require a little touching up with the rubber. The appearance may be enriched by having some of the parts bright polished and others dull, especially if the work is ebonised. If paint is the finish chosen, judicious colouring will prove very effective, but beyond saying that the colours should not clash with those of contiguous wall or curtains, directions can hardly be given. When painting it—or, rather, before doing so—let the position the pedestal is to occupy be well considered. The colour intended may look very well in itself, but might look anything but beautiful against a background out of harmony with it. Do not, therefore, so much regard the pedestal as a complete piece of decoration, but merely as an accessory. Plush may be named as a rich covering for the top, and all that has been said about paint colour applies with equal force to it. Enough, however, has now been said by way of suggestion, and the artistic worker may be left to his own devices for finishing the pedestal.

HOW TO MAKE AN OTTOMAN COUCH.

BY H. HINGE.

THIS very useful piece of bedroom furniture can be made by almost any amateur woodworker who is in possession of a few tools and a little skill and patience. To begin with, we shall require some ¾ in. boards, 11 in. wide, either white or red deal, moderately dry and clean; two pieces for the sides 4 ft. 7 in. long, and two pieces 2 ft. long for ends, and two pieces of 3 in. scantling 11 in. long. The wood, if it is clean, need not of a necessity be planed, except the edges; the ends should be cut off true and square, and the side pieces nailed out to one end in the form of a box; the other end the nails should only be pointed in. The pieces of scantling should now be prepared for the corners of this end by rounding one corner off till the end of piece is the shape of Fig. 1. These are fixed in the corners of the box and screwed firmly from the outside, keeping the screws as far away from the corners as it is possible, and still to get a firm hold in the block. The nails are now withdrawn and the corners rounded off (see Fig. 2, which is a plan of the bottom).

Of course, the couch can be made with a square end. If the round corners would be considered difficult, in that case blocks should be inserted in the corners of the bottom end, the shape of Fig. 3, and screwed from the outside of the box to keep it firmly together. The other end of box (we shall see later on) will be secured by the scrolls, etc. The bottom should now be screwed on. This is made of ¾ in. stuff running across the box (as indicated by dotted lines in the plan of bottom), and two screws at each end of each board, the last board being marked to shape of round corners, and rounded off and screwed on, the same as the others. The next job is to make the scrolls or arms, which can be made of 1½ in. deal, the shape of Fig. 4, and long enough to go down inside of box 6 in. at square end; the thickness of the box side is halved out of the scroll, so that when it is placed inside the box it comes flush (or level) outside. It is now firmly glued and screwed in position as in Fig. 4. The grooves in the scrolls (as seen in sketch) are to receive the cross rails. These grooves are ⅞ in. wide and about ⅜ in. deep. When both scrolls are fixed in their places, the rails, which are pieces of inch deal the required width and length (which can be got by measuring with a rule), are fitted in and nailed from the outside, care being taken not to split the scrolls. The top rail should have a block of 1 in. deal fitted in both corners and glued in, and when set, it should be levelled off to the shape of the scroll (this is to give strength). A piece of stuff should be fitted to the under side of the top rail, and glued and sprigged on to make out the shape of the scroll. Another rail should be fitted across the point marked A in sketch, 2 in. wide, being the height of scroll from top edge of box at this point. A piece of thin stuff should now be fitted in the inside of box under this rail the whole depth of box, to partition off the box from the scrolls. In cutting out the scrolls, it is best to make a pattern first, either out of very thin deal or cardboard, and in placing it on your stuff (which should be free from splits or shakes), so place it that the grain of the wood goes with it—that is, not to get the grain across it, or it will be liable to snap off. Cut them out with a bow saw, and with a spokeshave trim them up and take off all sharp edges to prevent them cutting the covering. We now want a lid. This is made of the required size out of 1 in. deal 2½ in. wide, keeping the end rail that comes on to the round corners 1½ in. wider; this can be halved together, and glued and screwed. A middle stretcher should be put in about 1½ in. wide, and hollowed out on the top side with a spokeshave to prevent it being felt when the ottoman is sat on. After it is made, it must be fitted to the top of the box, keeping it away from the rail A about ¼ of an inch to allow for the covering, etc., and the corners rounded on the wide rail to correspond with the box. It should now be hinged with a pair of butt hinges on either edge, just according to which way you want your ottoman to stand and open. Do not let your hinges in too much, or else when the box is covered it will be what is called "hinge bound"—that is, the covering will keep it from closing properly. Four "squares" should now be made of mahogany, or other hard wood, about 4 in. square, two of them rounded to correspond with the bottom of the box. These are screwed on to the bottom of the box about level with the outsides, to receive the casters. The "squares" are the only wood that is seen in our ottoman when complete, so they should be nicely made and polished or varnished; the casters should now be screwed on to the blocks. The casters called "pin casters," or "plate casters," will do very well. Our ottoman couch frame is now complete.

Our next proceeding will be to upholster

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it, and make it fit for use. First take off the lid, afterwards the bottom, numbering the boards where they belong to, to prevent getting wrong when putting them back. It should be lined with a nice small pattern chintz, and for covering nothing looks better than a pretty cretonne. Lining the box is usually the first job, which is done as follows:—Cut off lengths for sides and ends, always taking care to have your stuff an inch or two longer and wider than the finished size; line the ends first, covering past the corners a little, and tacking it down carefully, not driving the tacks home till you are sure you are right and your chintz is evenly strained; do not pull it too much, or you will break the glaze, and never make a nice job of it. Now put your side pieces on (with a few tacks pointed in to keep it in position), and turning it under nicely at the corners, with some ¾ in. fine brass gimp pins, fasten it neatly down; then placing the couch bottom upwards on your bench, or two stools, place the piece of chintz intended for the bottom (pattern side into the box) on it, and get it nicely in stretch, by first lightly tacking round, and not sending tacks down until it is evenly strained. Now replace the bottom, and pushing down a sprig-awl, or something of the kind, make a hole through the chintz; put no oil or grease of any kind on your screws in the bottom or it will mark the chintz. Now for the scroll, which we shall find the most difficult part to cover, but a little patience will master almost anything. We shall require some chair webbing, some flocks and canvas, and a little common calico for outer covering. Firmly tack three pieces of webbing across the scrolls, running the same way as the rails, one of the pieces right across the highest part of the scroll, the other two equidistant between the rails. (These must be pulled tight.) Upholsterers have a tool on purpose, but we can pull them as tight with a piece of wood about 12 in. long and 2 in. wide. After attaching one end of the webbing, wrap the other part round the long way of the wood, and using it as a lever against the other scroll, strain it tight, and before letting it go, secure it with tacks. It will be easily understood that the webbing must not be cut in pieces, but used off the piece, or else we should have nothing to pull by. Over the webbing tack a piece of strong canvas, getting this as tight as we can by pulling it with a pair of pincers. The canvas should go over the front or nose of the scroll and finish there, and then another piece of canvas, without webbing under, stretched across the front of the scroll (or under side as some would call it) where there is no pressure.

Now with some fine twine begin on the top of the scroll and form loops in the manner shown in Fig. 5 to put the flocks under. Keep tucking the flocks under the strings, making some loops across the canvas by stitching them in and tucking in the flocks until you have an even bed, say 2 in. thick, all over the scroll. Now cover this with calico, getting it nicely in stretch, and slitting a little here and there in the corners, to enable it to come down and tack on to the face of the scrolls. This should now be covered with cretonne, pointing in tacks all round till nicely and evenly stretched; then the under side covered in the same way over the canvas. It will, no doubt, greatly improve the amateur's work to pull in a few buttons in the arm (diamond-shape) with a long needle and thin twine, and "tie them off" on the under side before that part is covered. The box can now be covered with cretonne, turning under the top edge and fastening it down neatly on the top edge of box, and bringing it down and right under the bottom, and fastening off with tacks on the bottom of box. The lid should now be webbed by the same method as the arms were, crossing the webbing the same as the laths are in an iron bedstead. Cover with strong canvas, and form string loops right round the edge of the lid, and then fill the middle in with flocks, making it higher in the centre so as to form a nice round seat. Cover with calico, and finally with cretonne, tacking it on the under side. Now turn it upside down on something clean, and line the lid with chintz, turning in under all round, and fastening it off with brass gimp pins. Rehinge your lid, and fix a piece of tape at each end of box to the lid, to allow it to open just over square and keep it from going right back and breaking off the hinges.

We now want a "loop," or handle, to open it with, which should be made of a piece of webbing about 12 in. long, and covered with the cretonne. This should be folded together to form a loop, and firmly tacked to the under side of lid, and allowed to project far enough to catch hold of, in order to raise the lid, which is a considerable weight when stuffed and covered. This had better be fixed before the lid is lined, and then the lining will cover all up. Often workmen leave it for the last job and carefully withdraw a few pins in the lining in the centre of lid, and insert the web, and pull it out just as much as they want, and then tack it down again; but the former is the right way. We now want two pieces of cretonne, cut out the same shape as the scrolls, about ½ in. larger all the way round. Lay the couch down on its side, and make a roll of cotton wadding (or even flocks) about 2 in. wide down the centre of the scroll,

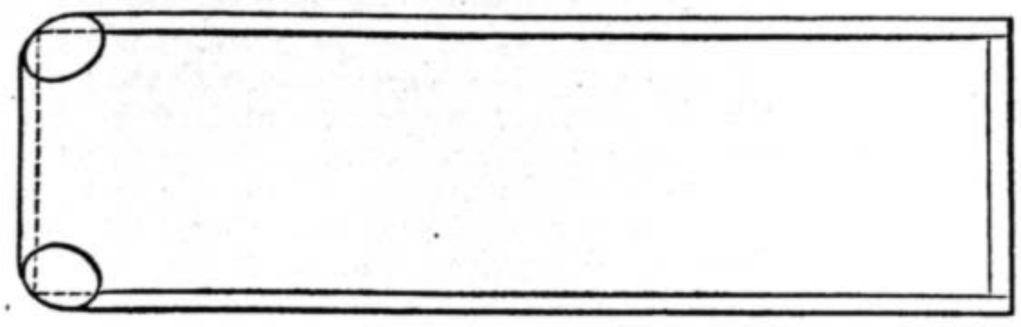

Fig. 2.

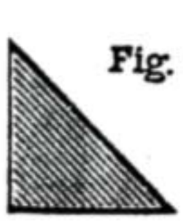

Fig. 3.

Fig. 1

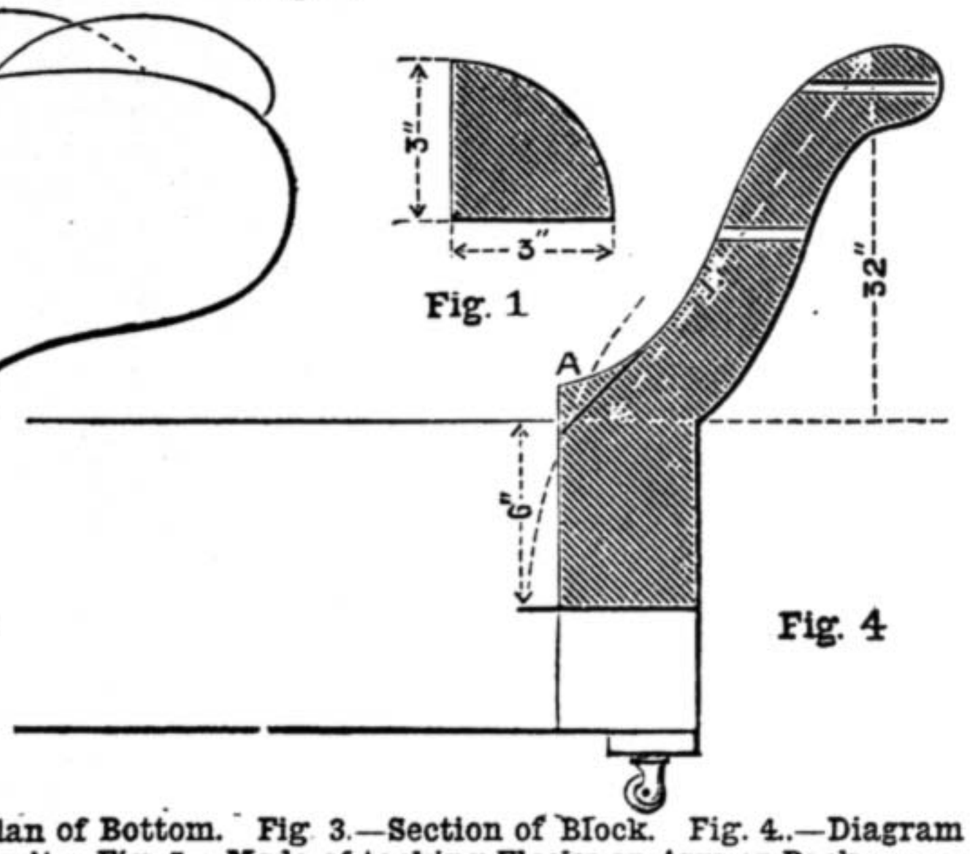

Fig. 4

Fig. 5.

Fig. 1.—Rounded Scantling. Fig. 2.—Plan of Bottom. Fig 3.—Section of Block. Fig. 4.—Diagram showing Arm and manner of fixing it. Fig. 5.—Mode of tacking Flocks on Arm or Back.

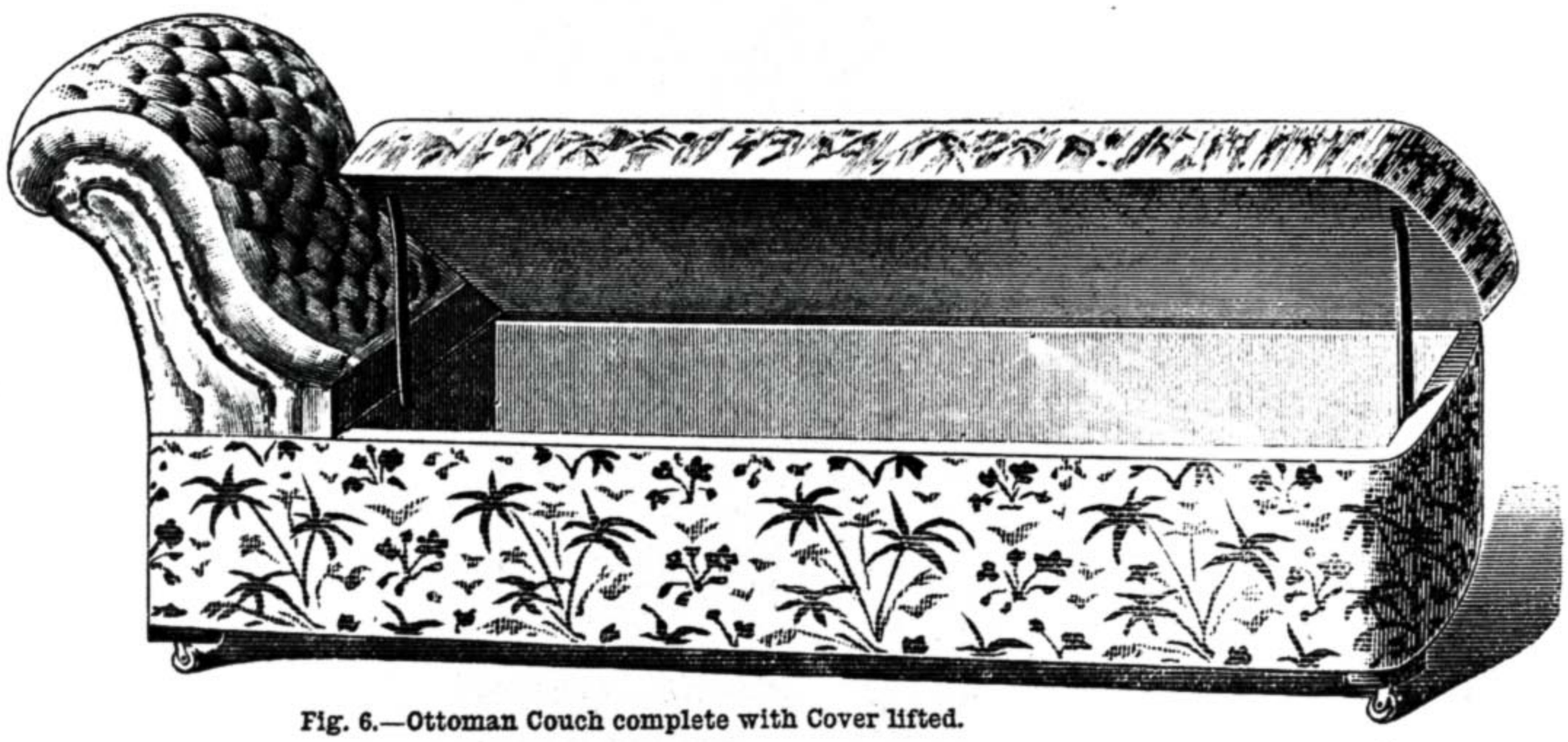

Fig. 6.—Ottoman Couch complete with Cover lifted.

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leaving a margin all round, and covering it with one of the pieces of cretonne, pointing in a few tacks to keep it in position. Now begin by turning under the cretonne and fastening down with gimp pins (withdrawing the tacks as we go along), nicking it anywhere out of sight with a pair of scissors, to facilitate turning in. It will form a nice raised scroll, and make a good finish. When both scrolls are done, the ottoman couch is complete. The secret of success of covering with any material is not to fasten it down all at once, but just point in the tacks (so that they can come out again) till evenly strained all round, then drive the tacks home. The sizes given are the dimensions of an ordinary couch, but, of course, a few inches can be added or taken off length, etc., to suit the size of room where it is going to stand, which will at once suggest itself to the worker.

Couches thus contrived and fashioned are extremely useful in bedrooms, where there is room for them as receptacles for articles of dress, linen, hats, bonnets, etc. They will also be found desirable at times of removal from one house to another for packing similar things. If intended for this purpose, the box should be furnished with a strong lock and key, and straps of stout webbing with buckles passed round them.

MEANS, MODES, AND METHODS.

A Wrinkle for Fret-Workers.

Fret-Workers never weary of adding to their stock of useful hints, and I can give them one more. I have not been of much use to this section of our readers, for the simple reason that I do not interest myself to a great extent in this branch of woodwork; but in preparing a design the other day, an "idea" struck me. My object is—preserve the pattern entire when once sawn through.

If the design is upon a page of Work, or paper which is not very stout, gum it to a rather thick piece. The following will suit for this, and also for drawings which are already upon thick paper.

Most designs are shaded. Place the design over a piece of carbon paper, and trace accurately with a bone or steel point over the outline of it, when a skeleton of it will appear on the other side. Pass a gum-brush, having a sharp point, over all portions of the drawing *which are not shaded*, keeping well within the lines, until all are evenly gummed. Then place the design upon the wood, previously having damped it if any of the gum upon it has dried. Of course, the other side of the wood should, in this case, be equally damped, to prevent warping.

When dry, cut through in the usual manner, and the result will be that the design can be taken off bodily, leaving the gummed portions upon the cut-out pieces of wood. It can then be used for months, by pencilling round its edge upon any other pieces of wood that are to be fret-cut. This is rather a laborious process, but in some cases the trouble expended would be well repaid. J. S.

A Staircase Gate.

Some of the many handy fingered parents in this world may have been put to it to devise a gate at the top of their staircases, to prevent their precociously quickfooted offspring from falling headlong and breaking their necks prematurely. When I was requested to make one some time ago, I thought first of bamboos, as being so light and strong; but I found them expensive, and not strong enough to take a spring catch or hinges, and besides, I had no time just then to bend them to any particular pattern. In the next place, I thought of the diamond trelliswork or netting frequently used in post offices as a counter-guard, and in many libraries as a substitute for, or in conjunction with, glass as a book protector. It can be purchased either in brass or galvanised wire, but as the size I wanted would have had to be made to order, and would have caused me delay, it was out of the question. Finally, I decided on making the gate of wood, as follows:—I bought a dozen banister rails, and two battens, 3 ft. by $2\frac{1}{2}$ in. by 1 in. The rails were rather longer than was required, so I cut a few inches off each end, and having bored out suitable holes, half an inch deep, in the two battens, I inserted the rails and glued them with liquid glue. The gate was to all intents and purposes now made. The two top edges of the battens were bevelled, so as to do away with any sharp edges. These battens were fixed to the banister post at the head of the stairs with two small, but strong, back-flap hinges; and one of Cartland's door-springs was fastened at the top to keep the gate always shut.

The gate shuts noiselessly against a pad of indiarubber, and is fastened, or rather fastens itself, with a small spring catch, something like a pew-door or show-case fastening, with a sunk ring to elude infantine eyes and fingers.

The whole gate was stained with two coats of Jackson's satinwood varnish stain, and matches very well indeed with the pitch-pine banister rails of the staircase.

The total cost, with fittings complete, was about 5s. 6d., which is little enough when the protection that is thereby afforded to the tenants of the nursery is taken into consideration. H. J. L. J. M.

Cramping up Joints of Thin Stuff.

In jointing wood, especially thin stuff, such as is used for panels, drawer bottoms, etc., if grooved and tongued, or only slip-jointed, great difficulty is often experienced in getting them close and keeping them together (if the wood is at all crooked or warped) while the glue sets. This difficulty may be overcome by making wood cramps of the following description:—Procure two pieces of stuff 6 in. longer than the widest board you want to joint, and about 3 in. or 4 in. wide, $\frac{3}{4}$ in. or 1 in. thick; and placing two of them together, bore a $\frac{3}{4}$ in. hole right through, 3 in. from the end. Serve the other end the same, and fit a dowel of hard wood, say 4 in. long, in each hole; drive them through both pieces, taking care not to have them too tight or else you will split your wood, and then open out your wood on the dowels the thickness of the board you want to cramp; your cramp will then have the appearance

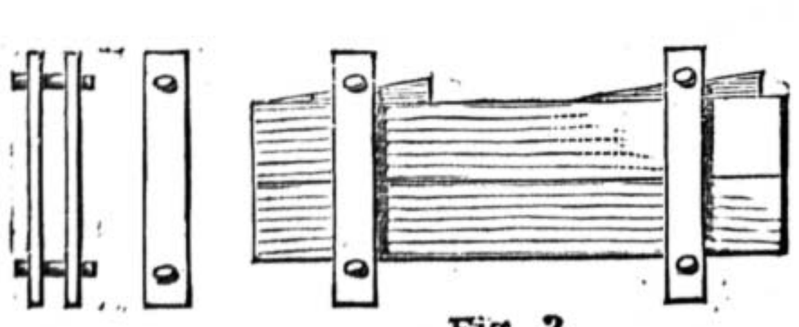


Fig. 1. Fig. 2. Fig. 3.

Fig. 1.—End View of Cramp. Fig. 2.—Side View of Cramp. Fig. 3.—Boards glued up and wedged in Pair of Cramps.

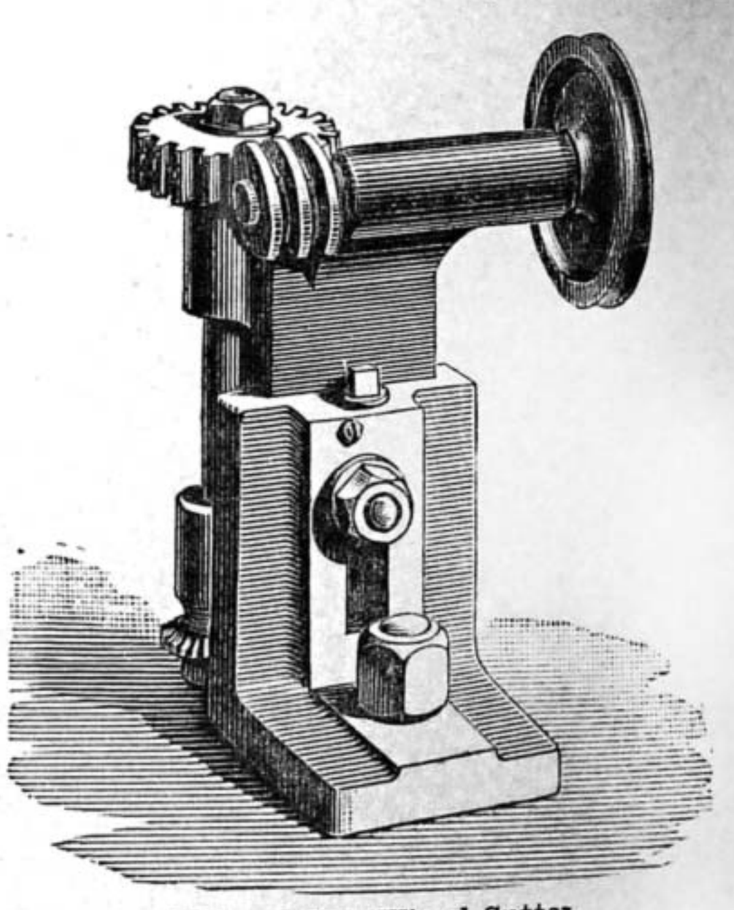
on end of Fig. 1, flat way of Fig. 2. If a pair of these cramps are made and slipped on to a joint, and two hard wood wedges, same thickness as the jointed board, driven gently between the top edge of the board and the dowel, as shown in Fig. 3, it will cramp up the joint close, and keep the board quite straight and firm till the glue is set. Holes may be made in the cramps so that the dowels can be put in for different breadths of stuff, and they will easily adjust themselves to the thickness of stuff by simply opening or closing them on the dowels. H. H.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of* WORK *for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of* WORK *without charge, the notices given partake in no way of the nature of advertisements.*

117.—Milnes' New Wheel Cutter.

Readers of Work who are turners will like to have a description of a wheel cutter just brought out by Mr. H. Milnes, of Bradford, of which an engraving is given here. The illustration shows the cutter as fixed upon the tool-plate of the slide-rest by means of the bolt used to clamp the tool; it is, therefore, very easily and quickly fixed and unfixed. The motion is received by a 3 in. pulley from the band of the overhead motion; the quick speed of this band is transformed into the slow and powerful motion required for the cutter by a worm and wheel, whose smooth and quiet action is very superior to the rattle of gearing. There is a simple vertical slide for the height adjustment, after making which a nut is used to clamp the slide. The cutter spindle has hardened necks, working in hard steel collars; I took it out for examination, and found them very smooth and bright. There are twenty teeth in the gun-metal worm wheel, and it takes from three to four treads of the foot wheel to turn the cutter once, so that it turns slowly and with great power. The worm and wheel are too large and strong in this first cutter, but they will be reduced, and the small worm shaft will also be hardened and run in hard collars.



Milnes' New Wheel Cutter.

The saddles of Mr. Milnes' lathes, as now made, allow the rest to be drawn so far back that the cutter can take a cut across the face-plate, or cut teeth in a wheel 7½ in. in diameter. The cutter costs £4 10s. The Editor.

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SHOP:

A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

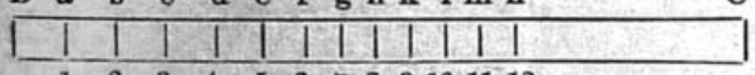
In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Riddles and Wire Gauge.—J. S. (*London, N.*) writes, in reference to C. T. C.'s remarks (No. 91, Vol. II., page 631):—"You must pardon me for asking whether you would not have given a similar reply to that which I sent in answer to DANDY ROLLER (No. 86, page 553)? You say 'it is gradually being used' (the imperial standard wire gauge), thereby proving that there is no universally adopted gauge; and it might have been reasonably expected that had I given numbers relating to thicknesses of wires, no useful purpose would have been accomplished. Evidently DANDY ROLLER is not a riddle maker, or he would hardly have asked the question; therefore, he might have had difficulty in procuring an imperial gauge. I am intimately acquainted with, and by the time this letter is in print shall be relatively connected with, one of the oldest wire-working families hailing from Birmingham. It is on this account that our Editor requested me to write a series of papers on wirework. This family uses an old gauge, which, however, is being discarded. There is a gauge several inches long and about 1 in. wide having a groove or slot down its middle lengthways, the slot being of a certain width at one end, and tapering down to an extremely fine point at the other end. Along the sides of the slots are numbers. I, and doubtless many others, would like to get to the bottom of this gauge question; and for myself will thank you or any other wireworker to give me the benefit of your views through the columns of 'Shop.'"

How to Fret a Banjo.—F. W. C. (*India*) writes:—"Your correspondent R. H. H. (*Crewkerne*) (see page 503), writing on this subject, says:—'Next divide the distance from the nut to the bridge by eighteen, and the first eighteenth is the place of the first fret'; he does not show how he arrives at the figure 18, nor is it correct, though possibly sufficiently near. In the sketch let B C be the length of

B a b c d e f g h k l m n C



1 2 3 4 5 6 7 8 9 10 11 12

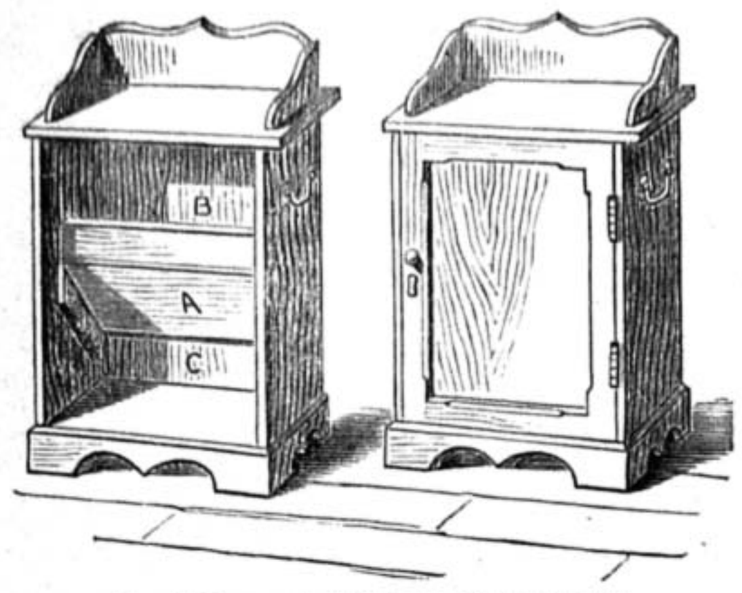
the open string, and Ba, ab, bc, etc., be the lengths of the frets, and let x represent the proportionate part of B C required for Ba. Then $Ba=\frac{A}{x}$ and a $C=A-\frac{A}{x}=\frac{A}{x}(x-1)$; similarly $ab=\frac{aC}{x}=\frac{A}{x^2}(x-1)$ and $bC=\frac{A}{x}(x-1)-\frac{A}{x^2}(x-1)=A\left(\frac{x-1}{x}\right)^2$ and $bc=\frac{bC}{x}=\frac{A\left(\frac{x-1}{x}\right)^2}{x}$ and $cC=\frac{A}{x^2}(x-1)^2-\frac{A}{x^3}(x-1)^3=A\left(\frac{x-1}{x}\right)^3$, and so on till the twelfth or octave fret $nC=A\left(\frac{x-1}{x}\right)^{12}$. But as the octave note of a string is always half the length of the open string $A\left(\frac{x-1}{x}\right)^{12}=\frac{A}{2}$ or $\left(\frac{x}{x-1}\right)^{12}=2$. This gives x=17·818, and not 18. The correct lengths of the frets for an open string of 26 in. are as follows:—

To	1	2	3	4
	1·46	2·836	4·136	5·363

and so on."

Artificial Water.—W. E. D. (*Hull*) writes to J. M. (*Manchester*):—"I thank you for your reply (see page 603) *re* 'Water for Models of Ships'; however, the kind you name hardly answers my purpose. I wish to make working models, and the water to move up and down with the ships. Perhaps you would be kind enough to inform me on this point."

Coal Box.—W. H. P. (*Hornsey*) writes:—"I enclose you a rough sketch of a coal box I made some time ago. The idea occurred to me when Mr. J. Scott's coal and coke box appeared on page 81, Vol. II. of WORK, and as my son was just beginning to run about and sort out the coals in the scuttle, I thought that with a little alteration of the interior, it was just what I wanted, so I set to and made the enclosed. It is made of ¾ in. pine, except the door, and that I made of ½ in. mahogany. Outside measurement: 32 in. high, 16 in. wide, 15 in. deep. The slanting division, A, I fixed about halfway, 1 in. from front at top, and 3 in. from back at bottom, and a piece 4 in. wide above A to keep the coal in. You put the coal in at B and shovel them out at C, and as you take them out, others fall in their places. Of course you cannot use large coal, but for nuts it is just the thing. It holds from three to four scuttles full. I gave it two coats of Aspinall's Black Enamel, and put a lock and a pair of brass handles on it. A piece of zinc at the bottom



Coal Box, with Door and without.

would make it wear better. You know it is very awkward to shovel up coal out of the scuttle, but here it is very easy and clean."

Heating Plant Case.—J. T. (*Hull*) writes:—"As you were kind enough to reply to my inquiry (see page 521, No. 84), I enclose herewith a sketch of what I have done in hopes that it may prove of

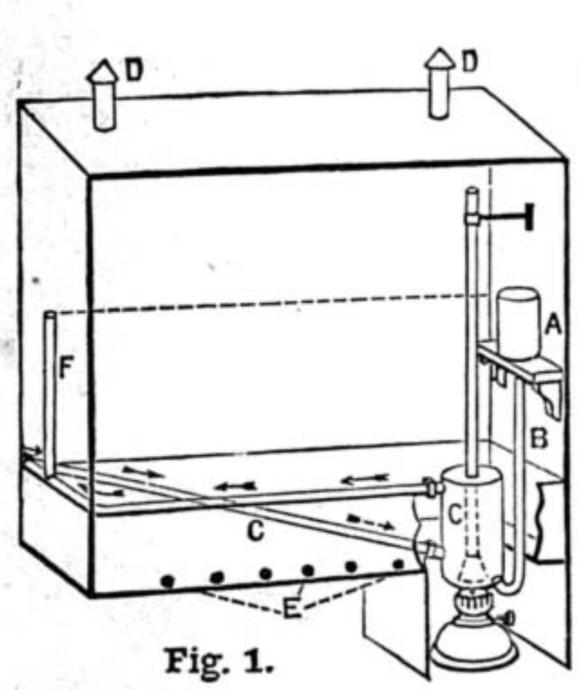


Fig. 1.

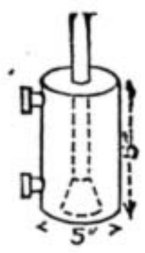


Fig. 2.

Fig. 3.

Plant-Heating Case. Fig. 1.—A, Cold Water; B, C, ¼ in. Gas Pipe; D, Foul Air; E, Fresh Air; F, ¼ in. Vent Pipe; G, ½ in. Gas Pipe. Fig. 2.—Tin, 8×5. Fig. 3.—Copper Tube for Boiler.

help to some of your readers. You will notice that I have added a cold water cistern to supply the boiler with water, which answers very well. I am able to keep 60 degrees with a small lamp."

II.—Questions Answered by Editor and Staff.

Emigration to South Africa. — ABSTAINER. — You do not give either your name or address, so I am utterly unable to answer you by post; and not knowing where you live, and, therefore, what large seaport you may be near, I cannot well advise you as to your route, etc. With the knowledge of the various trades that you possess, I should say go to the Cape or Natal by all means, or, preferably, up the country. Send your name and address, which will be held in confidence by me, and then I will endeavour to give you a useful hint or two.

Books on Carpentry and Joinery.—A CONSTANT READER.—Write to the Britannia Company, Colchester, for their new Catalogue of Technical Works, sending 7d., which is 6d. for the catalogue itself, and 1d. to frank it through the post. You will find many works on carpentry and joinery mentioned therein at various prices, and be able to make a choice that will suit your requirements and pocket.

Book on Tin-Plate Working, etc.—T. K. B. (*London*).—See above reply to A CONSTANT READER, and follow the advice given to him. The making of saucepans has been dealt with by Mr. R. Alexander in No. 93 of this Magazine, as perhaps you will have seen before this comes under your notice.

Book on Timber.—BRECKNOCK.—A work on this subject, entitled "The Timber Merchant and Builder's Vade-Mecum," is published by Messrs. W. Rider & Son, Bartholomew Close, London, E.C., and was noticed in No. 81 of this Magazine."

Upholstering. — S. R. (*Chelsea*). — Upholstery work will receive due attention. In the meantime, if you will let us know on what specific point you desire information we will endeavour to help you. There is no book which we would care to recommend unreservedly, as there is none which would be of any real assistance.—D. A.

Dialling.—J. C. (*Rugby*) can doubtless get the rule he requires from any large tool shop—say Buck's, Holborn Viaduct, London. He would do well to write describing what he wants, and inquiring the price. He can then send remittance with order.—A. G.

Etching Classes.—E. A. S. (*South Norwood*).—You would do well to write to the Secretary of the Technical Institute, Finsbury, as to classes in etching near the Royal Exchange.—C.

Crucible.—NO NAME (*Leicester*).—You might melt in the furnace you sketched. But metal must be thoroughly fluid to be any good. No coal, but coke, and preferably hard or furnace coke, like that employed by iron-founders, should be used. Gas coke will answer, but will be longer in melting. No flux is necessary for melting up turnings, but only for casting into moulds. After you have melted the turnings, pour the metal into a cast iron ingot mould to be melted over again for casting. Then, just before pouring into the mould, drop a bit of yellow soap into the crucible and stir. You can obtain a crucible of the Morgan Crucible Company, Battersea, or of the Soho Crucible Works, Wakefield. The price is a trifle over a penny per pound capacity. Thus a 20 lb. crucible would cost 1s. 10d.; a 24 lb. crucible, 2s. 3d. Either of these sizes would suit you. Model gauge glasses of Bateman, High Holborn, or Lee, High Holborn.—J.

Brass.—J. A. W. (*Glasgow*).—A series of articles on brass moulding, etc., to appear in the future, will contain some chapters on the subject. For metal, write to Messrs. Osborne & Co., 11, Great Garden Street, London, E.—J.

Machine Saw.—J. A. (*Wandsworth*).—An ordinary bow saw, 20 in. long, answers very well both for ripping and cross-cutting, also for circles and fancy shapes. No roller is required to take the thrust; this is provided for by the beam and connecting rods under the table. A roller or stop of any kind at the back of the saw would be injurious, as it would cause friction, and heat the saw.—F. H. R.

WORK Numbers.—S. R. (*Newry*).—Volume I. contained 52 weekly numbers. Volume II. began with No. 53, and will end with No. 101; and the publication will be continued in this order.

Microscope.—H. E. A. (*Peterborough*). — An article on "Microscopical Work" will be found in WORK, No. 94, page 681. You should purchase an Index to Volume I., and also that to Volume II., when it is published.

Taking out a Patent.—UNCLE finds that his invention has been forestalled, but that the former inventor allowed his provisional protection to elapse without completing his patent. Being in doubt as to whether, under the circumstances, he can or cannot himself obtain a patent, his prudent course will be to make some small improvement on the idea, so as to effect a colourable difference, and then to apply for the patent. The former inventor has (presumably) tried the invention in the market. As it stands, it must be considered to have been published, and to be known to her Majesty's subjects, and to be therefore no fair subject for a patent. But it would be otherwise if it were combined with an improvement. UNCLE could scarcely feel safe in applying for a patent for an invention of which he well knew that he was not the first and true inventor, without adopting the above legitimate expedient.—C. C. C.

Fluted Silvered Glass.—REFLECTOR.—I think you will be able to get this at Messrs. P. E. Chappuis & Co., 69, Fleet Street, London, E.C.

D Dulcimer.—G. H. (*Camberwell*).—The dimensions of a D dulcimer are as follows:—Length in front, 2 ft. 10 in.; at back, 1 ft. 4 in.; depth of shell, same as for F. The position of the inner bridges are: for the right hand, 3½ in. from the block, and for the left hand, 12½ in. from the bottom and 5½ in. from the top corners of block. Four sound-holes are generally put into a D, and the dots or marks for the centre of these should be made at a distance of 5 in. from the bottom and top edges, 6 in. from the left block for the treble, and 9 in. from the right block for the bass. These should be of 2½ in. diameter for the two lower, and 1¾ in. diameter for the upper ones. The bridges would be the same size as for F.'s, and the wire for stringing would be Nos. 10 and 9 brass and 9 and 8 steel. You would find some difficulty in playing a D and F together, as the difference in pitch (a minor third) would necessitate a considerable amount of "cross-fingering"; but if you were to raise the pitch of your F to G—which it would stand very well if the wire is good—it would be much easier to play them together, although you would not play in the same key on each. The two best instruments to play together are either two of the same pitch, or a D and an octave or piccolo D. For a description of this, see page 615, No. 90.—R. F.

Electro-Motor and Dynamo.—ELECTRO.—The cost of making either an electro-motor or a dynamo will depend very much on the quantity of work you can put into these machines yourself. The rough castings for a small dynamo of five candle-power will cost from 5s. to 6s., and those of a motor about the same. The wire may cost you about 10s. more for each machine. If you have to pay for the labour of fitting the castings ready to be wound, it will cost you from 10s. to 15s. more. You can buy a small dynamo complete for 15s., and a motor for a sewing-machine for 30s. The cost of working these will depend also on the cost of motive power, and this must be reckoned at one man-power for each machine.—G. E. B.

Electric Lighting.—J. F. P. (*Saffron Walden*).—A series of articles, entitled "Model Electric Lights," by Mr. Bonney upon this subject is now running through Vol. II. of WORK.

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Foreign and Colonial Patents.—CON-JUNGO.—Each country and colony has its own patent laws. The number of inventors who seek protection abroad is comparatively small. Application has to be made to the Government of that country in which the patent is required. Copies of the Patent laws of most foreign countries are in the Free Library of the Patent Office, Southampton Buildings, and may be inspected there daily from 10 to 10 o'clock. There is a monthly publication specially devoted to international protection—*La Propriété Industrielle*. It is published by the office in connection with the International Convention for the Protection of Industrial Property. Publishers, Jent and Reinert, Berne, Switzerland; price, yearly, post free, 5 f. 60 c.—C. C. C.

Firing Terra-Cotta Busts.—C. T. B. (*Kilburn, N.W.*).—The person to fire your busts would be Mr. Lucchesi. His address is, or was, 75, Euston Street. Euston Square, London. Should he have removed, you can doubtless find him through the Directory.—M. M.

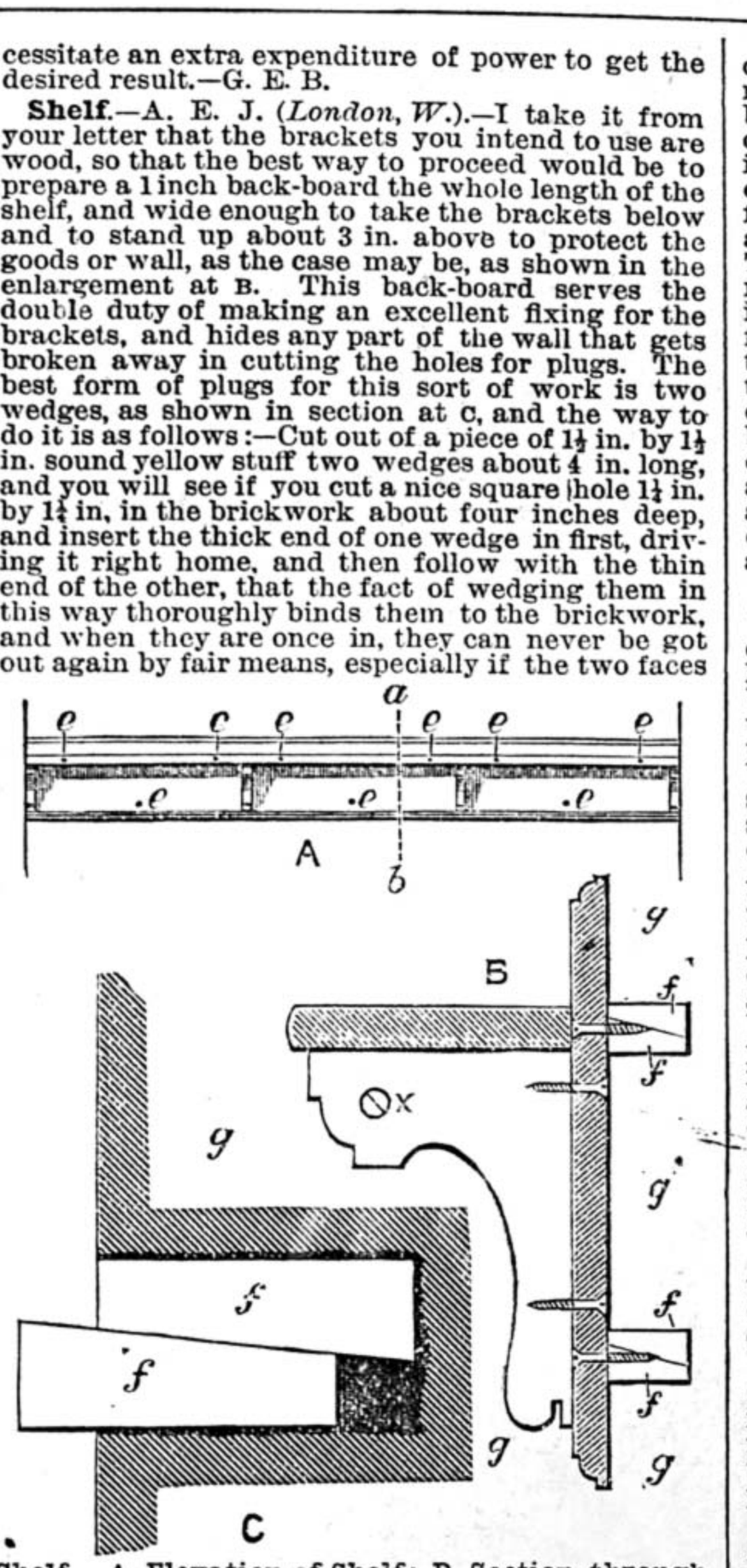
Amalgamating Zinc.—J. J. M. (*Leith*).—Dissolve ¼ lb. of washing soda in one quart of hot water, and wash the zinc plates in this to free them from grease; then rinse them in clean water. Get a stoneware baking-dish, or a deep soup-plate, and put in it a mixture of 1 part oil of vitriol added to 3 parts of water. Put in first 3 wine-glassfuls of water, then add carefully and slowly, 1 wine-glassful of oil of vitriol. Always add the acid to the water *slowly*, as the mixture of the two becomes almost boiling hot, and may spurt about violently. It will blister the skin and burn holes in clothing, so be careful in mixing the oil of vitriol with water. Into the hot mixture pour an ounce or two of mercury—that is, quicksilver; then put in the clean zinc plates one at a time and move each plate about with a stick until the under side is coated with mercury. Turn it over and get the other side coated; then get it out and rub both sides with a wisp of hemp, tow, or linen rag, with a few bits of brass or copper wire in among the wisp. This will cause the mercury to spread evenly all over the sides of the zinc, and cover it with a bright coat of quicksilver. This is named amalgamating the zinc. Treat each plate in this manner, and thus prepare them for use in the battery.—G. E. B.

Galvanometer.—J. T. G. (*Edinburgh*).—You have done quite right so far as you have gone. There is a lozenge-shaped permanent magnet inside the coils—that is to say, there is a piece of hard steel exactly the shape and size you mention. This piece of steel is magnetised and fixed by means of small nuts to the spindle which carries the index needle. The two bobbins are wound with two sizes of wire. First, there is one layer of No. 22 silk-covered copper wire for use when measuring low tension currents. Wind the same quantity on both bobbins, leaving out two small spirals of wire at each end to make connections. Now wind 1 oz. of No. 36 silk-covered copper on each of the bobbins (over the large wire) for use when testing for faults in the line wire. Place the bobbins together with the magnet inside, and connect the wires as you have seen in the galvanometer you mention. Be sure to wind on the wires regular, side by side, and see that they are nicely coated (no breaks, knots, or kinks), and connect the outside or finish end of one coil to the inside or commencing end of the next.—G. E. B.

Electrotyping Casts in Plaster and Wax.—CREWKERNIAN.—The casts must be coated with blacklead, by brushing them with a soft brush charged with very finely powdered best blacklead, applied dry. They must then have a number of fine copper wires stuck in the edges near the design, and these connected to a stout leading-wire of copper, also stuck in the back of each cast. This wire and the small wires serve as conductors of the current to the face of the casts. The casts are then suspended in a solution of copper sulphate and connected to a battery or to an electrotyping dynamo machine until a sufficient thickness of copper has been deposited on them. This is an outline of the process. You will find full details in my article on "Electrotype Copies of Busts," published on August 9th, 1890, in No. 73 of WORK. See also reply to D. G. (*Moorfields*), published on October 11th, 1890, in No. 82 of WORK, p. 489. These back numbers are in print, and can be obtained at a penny each from any newsagent.—G. E. B.

Connecting Cells of Smee Battery.—T. M. (*Belfast*).—Connect the platinised silver plate of one cell by means of a length of copper wire with the zinc plate in the other cell; then connect the silver plate of the second cell to the zinc plate of the third cell, and so on to the end of the whole series or string of cells. This will leave a zinc plate free at one end, and a silver plate free at the other end. Connect one of these to the bell, and the other to the line wire. Lead a wire from the bell to a copper plate buried in damp soil, or connect the wire to a gas pipe or water pipe. At the other end of the line take a wire from the push to an earth plate or water pipe. The earth will convey the current instead of a wire, and a naked wire may be used for the line if this is insulated from the earth by supporting it at intervals on glass or porcelain insulators. The Smee is not the best for bells, nor is the system adopted by your friend the best or most economical; but a bell *can be rung* by such means as you mention. The wire will not suffer much from exposure to the weather, but the resistance will be great, and this will necessitate an extra expenditure of power to get the desired result.—G. E. B.

Shelf.—A. E. J. (*London, W.*).—I take it from your letter that the brackets you intend to use are wood, so that the best way to proceed would be to prepare a 1 inch back-board the whole length of the shelf, and wide enough to take the brackets below and to stand up about 3 in. above to protect the goods or wall, as the case may be, as shown in the enlargement at B. This back-board serves the double duty of making an excellent fixing for the brackets, and hides any part of the wall that gets broken away in cutting the holes for plugs. The best form of plugs for this sort of work is two wedges, as shown in section at C, and the way to do it is as follows:—Cut out of a piece of 1½ in. by 1½ in. sound yellow stuff two wedges about 4 in. long, and you will see if you cut a nice square hole 1½ in. by 1½ in, in the brickwork about four inches deep, and insert the thick end of one wedge in first, driving it right home, and then follow with the thin end of the other, that the fact of wedging them in this way thoroughly binds them to the brickwork, and when they are once in, they can never be got out again by fair means, especially if the two faces



Shelf. A, Elevation of Shelf; B, Section through *a b*; C, Enlarged Section of Plugs, *f*; *e*, Position of Screws; *f*, Plugs; *g*, Wall.

of the wedges that touch are smeared with glue before driving them in. You should prepare the back-board first and fit it into its place, then take it down and mark out the position of the shelf and brackets. The brackets should be housed into this and also into the shelf; the shelf would, of course, bear much more weight if it were ploughed into the back-board. Next bore the holes for screwing the back-board to the plugs, as shown in the elevation A. The six top holes are put directly behind the shelf, so that the shelf, being fixed last, hides them. Now offer the back-board up to its place and mark through these screw-holes on to the wall behind, and this will give the exact centre of the holes to be made for plugs. Take down back-board, plug wall (cutting off any piece of plug that may project beyond the face with sharp chisel), screw the brackets on the back-board as section B, and you can now fix the whole back to the wall, except the shelf, which you now lay on and nail or screw to brackets, as you think best. The two end brackets might with advantage be screwed to the side walls, as at X in section B. A much simpler and less expensive way to fix the shelf would be with iron brackets in the centre simply screwed to wood battens about 4 in. wide fixed to plugs in wall as above, and a fillet under each end fixed to side walls.—E. D.

Books on Electric Bells.—T. M. (*Belfast*).—"Electric Bells," by S. Bottone, 3s., Whittaker and Co., London, E.C.; "Practical Electric Bell Fitting," 3s. 6d., F. C. Allsop, 165, Queen Victoria St., London, E.C. Either of these will suit your requirements.—G. E. B.

Granule Battery.—WATER LILY.—Theoretically considered, a battery should yield current according to results reasoned out by Ohm's law. That is to say, knowing by measurement the internal resistance of each cell, and the E.M.F. of each pair, the volume of current given at the terminals should equal the total E.M.F. divided by the total resistance. But, from the moment of closing the circuit of a battery, there are changes set up in the battery itself which entirely upset our theoretical calculations. The most potent of these arises from the hydrogen determined to the negative element by the decomposition of the battery liquids. If this is absorbed there as fast as it is formed, very little alteration is observable in either the E.M.F. of the battery or its internal resistance. But, if the hydrogen is allowed to collect on the negative element, it offers a counter E.M.F. to that of the elements, and also increases the internal resistance of the cells. In all bichromate of potash batteries this tendency to accumulation of hydrogen on the negative plate is most marked, and the fault increases with increased demand for current, because there is an increased volume of hydrogen formed when the volume of current is increased, as by having a low resistance in the outer circuit. This fault is due to the use of an imperfect depolariser, the bichromate of potash being slow in yielding up its oxygen to combine with the hydrogen formed in the battery cells. The Granule battery, being a bichromate of potash battery, shares the fault peculiar to its class, and therefore the current soon falls off after the outer circuit has been closed. The E.M.F. of each pair—*i.e.*, each cell—is as you state: 1·8 volts. The internal resistance of the size cells employed by you would be about ·08 ohm. Taking the total E.M.F. of your 24 cells as 43·20 volts, and the total internal resistance as 1·92 ohm, we should have by Ohm's law,

$$c = \frac{E}{R} \quad \frac{43{\cdot}20}{1{\cdot}92} = 22{\cdot}5$$

ampères as the total current obtainable from the battery. Now, if we demand a larger volume than 3 ampères of current from this battery, it will polarise so rapidly as to be almost useless in half an hour, but will work fairly well whilst yielding a current of from 1·5 to 2 ampères. What we have to do then, to get the best results from your battery, is to place a lamp of sufficient resistance in the circuit to pull down the current to from 1·5 to 2 ampères. As you only wish to use 20 cells at a time, I think you might employ a 35 volt 16 c.-p. lamp, and this would take about 1·3 ampères of current to light it. If you decide on arranging the cells in three sets of eight cells in series in a set, then get three 12 volt 5 c.-p. lamps. You might try three 14 volt 8 c.-p. lamps, but I fear you would not get current enough to properly light them. I think you would get better results from chromic acid than from bichromate of potash, and use Zn Cl instead of NH_3 Cl in porous pot. I do not know the Victoria Leclanché. All such batteries are only suitable for intermittent lights of from 2½ to 5 c.-p. You cannot get a strong light from them, nor for a longer period than ten minutes at a time.—G. E. B.

Mail Cart Wheels.—J. G. (*Somerset*).—For these you should apply to the Victor Cycle Co., Grimsby, who advertise in the "Sale and Exchange" column of WORK.

Stereotypes.—CREWKERNIAN.—I cannot condense a useful description of the process into a sufficiently small compass to suit the limited space at my disposal in "Shop." Without doubt, as soon as the Editor can see his way to do so, one or two papers on the subject will be given.—G. E. B.

Compound Kaleidoscope.—R. W. J. L. (*Gawler, S. Australia*).—The specialist of WORK staff cannot direct you where to buy, but he will write you as to one of his own make for sale.

Ebony.—E. H. B. (*Marple*).—I do not think you will be able to get the ebony as wide as you require it, but you can join it. Write to Snewin, Timber Merchant, Back Hill, Hatton Garden, E.C.—A. J. H.

Timber Pieces.—G. R. (*Hull*).—Few yards care to cut off short pieces of timber, and as the size you require is not a stock size, you had better get two pieces and join them. I expect the nearest size obtainable will be 8 in. × 8 in., and this you may not be able to get in yellow pine; but you should be able to get red pine, and some of this is soft and easy to make. Here are some firms in Hull you could try, but I am not sure if they cut small quantities:—H. Smith & Co., Hull; W. Hodge, North Side, Queen's Dock; Wikner & Co., Hull; Simpson & Co., Hedon Road, Hull.—A. J. H.

Sign Writing.—C. M. (*Gloucester*).—A letter awaits you at the office of WORK. Please send full address.

Clock-Work Turn-Table.—A. J. L. (*Walthamstow*).—By all means send in description and sketches of your machine—*on approval*.

The Seal Gas Engine.—J. L. (*Leeds*) and others.—Full particulars of the above can be had by writing to J. Seal, 67, Carthew Road, Hammersmith, London, W.

Glass Writing.—H. P. (*Plaistow*) refers to my answer in No. 79, page 436, and says:—"I am much interested in above subject, and with reference to advertising tablets (opal and other glass). The Brunswick black I believe is removed from tablet by stencils. This is my difficulty: how to remove the B B through the pattern. You can understand it would take too long a time to paint them separately. B B is painted all over glass, and pattern brushed out or removed, how?"—I do not understand the foregoing, and will not criticise—that would be cruel; but will H. P. really say what he wants, and then I or someone else will endeavour to help him. I do not think he understands the answer I gave on page 436: that is glass embossing; but I judge what he wants to know is something in reference to lettering labels and signs. He says, the "B B, I believe, is removed by stencils." Is not the stencil laid on the surface to be lettered? And when removed, will it not of course remove the B B, except the stencilled letters? That is plain enough; but he says, "This is my difficulty: how to remove the B B through the pattern?" Does he mean any B B which has soaked through the pattern? I hardly think he does, yet what else he means I cannot tell, as he certainly does not want to remove the

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letters which have been stencilled. The last sentence is a conundrum, and I must give it up. "B B is painted all over glass, and pattern brushed out or removed, how?"—O. B.

Air Compressing Pump.—EXPERIMENT.—You would undoubtedly obtain more power by heating the air, and it could be done by putting a fire under the receiver, but this, of course, will consume fuel, and, in fact, make your machine a hot-air engine. A paragraph in your letter suggests that you expect, when you have once charged your receiver, the engine will go on compressing sufficient air to work itself. This would make it a perpetual motion machine—in fact, you would be obtaining power (if only to overcome the friction of the mechanism) from nothing, a result which is mechanically and physically impossible. Your engine will run just so long as the pressure you put into the receiver to start it lasts. If the air is heated by a fire, that is another matter altogether. If my surmise is correct, do not waste time or money on what must prove a failure.—F. C.

Fixing Dial by the Compass.—G. S. (*Walworth*).—It is to the true or astronomical north, and not to the magnetic, that the dial will have to be set. At page 436, Vol. II. (No. 79), directions will be found for fixing a dial by the compass. It is not easy to state precisely the amount of the variation of the needle. The annual variation is now very small, and practically unimportant; but there are local variations depending on local causes, and there are diurnal variations; the needle may also be much affected by magnetic storms. Roughly, perhaps, the variation at Greenwich may be some 18° or 19° W. In taking a walking tour by the aid of a map and pocket compass, the tourist will, we presume, scarcely be so particular as to take the declination of the needle into account, unless he is travelling for scientific purposes.—A. Y.

Roof.—I. F. (*Mullingar*).—I know of no composition with which you could point the slates on the outside with the idea of making the joints proof against the drifting rains. The only thing left for you to do now is to get under the slates from the room below, even if you have to cut a hole in the ceiling, and point between the tails of one course and the heads of another with hair mortar, or, better still, render all over the under side. Of course, you could not do the above if the roof is boarded, and from your letter I should think it is not; but if it should be, you had better strip it, and cover the boards with sarking felt, and re-lay the slates. This latter is a good plan, and delays the passage of heat and cold.—E. D.

Improvements in WORK.—G. P. (*Elgin*).—All the suggestions you are kind enough to offer have been before us before. All have had and will have every consideration.

Back Numbers of WORK.—A. B. (*Aylesbury*).—As your bookseller is so dilatory in obtaining for you the back parts of WORK, you should apply direct to the publishers—Cassell & Co, Ludgate Hill, London, E.C. So, too, should every intending subscriber who may be in a similar plight to you.

Improved Attachment for Lathes.—C. H. S. (*Nottingham*) and others.—For information *re* the above (see page 583, Vol. II.), apply to the makers, Messrs. F. M. Rogers & Co., 21, Finsbury Pavement, London, E.C.

Blinds.—W. W. (*Brixton*).—I appreciate your ingenuity, but can see no probability of profit by persevering with your idea. Venetian blinds are now out of fashion; they will some day again be the right thing, but not yet. Even roller blinds are now being discarded in favour of curtains. But if Venetian blinds were universal, the "cord guide" is not required if the pulleys are good and fit the mortices in which they turn, nor do the pulleys break with fair usage, while in the case of wheels which do not fit the mortice, indicating either wheels not to gauge, or bad morticing, the blind maker will continue to adopt the usual remedy rather than purchase your guides.

Bolt Heads.—W. H. (*Leeds*).—My next article on "Modern Forging" will contain a description of bolt making in the shops, but you must have some appliances and tools.—J.

Petroleum Engine.—R. J. D. (*Edinburgh*).—Doubtful if a small petroleum engine could be made to work. Priestman, of Hull, makes the best in the market. But there is a lot of difference in a model and a large engine. Your safest plan is to get a specialist like "Dugald Clerk," of Birmingham and Manchester, to prepare a design, or advise on the practicability of it.—J.

Repairing.—H. D. (*Hull*).—It is very unlikely that you will be able to match the exact pattern of the stringing on the old furniture you are repairing, as the stringings are made up in large quantities, and it would not pay to make a small lot just to do a repairing job with. Very often the best and most economical way in repairs is to piece up any defective parts of the stringing with bits of suitably coloured veneers. This, of course, means labour. If you determine to buy new stringing, you will find as large a stock at D. Witt & Palmer's, Drummond Street, Euston Square, N.W., as anywhere. It may be easier and quite as cheap for you to buy what you require through a local cabinet maker. You will see that I have referred to inlaid stringing, but if what you want is plain, you can easily make it yourself or buy it from any dealer.—D. D.

Commode.—HONOUR OLD AGE.—A "comfortable" article is that shown herewith. Next to comfort, ranges plainness and simplicity of construction, as you desire. First, there will be a plinth (*i.e.*, bottom part), for making which you will glean sufficient information in back numbers. To the plinth is screwed the carcase proper, which need be nothing more than a plain box with a circular hole in the top. It will answer very well to have a mock panel in front—that is to say, a moulding mitred and glued on to a plain board, instead of having a framing. Pans you can obtain at several shops. The description of the arms and lid must receive your closest attention, as if not made correctly, they will not close together as they are intended to. Four rails morticed and tenoned will make an arm. The height of each arm must be a

Fig. 1.

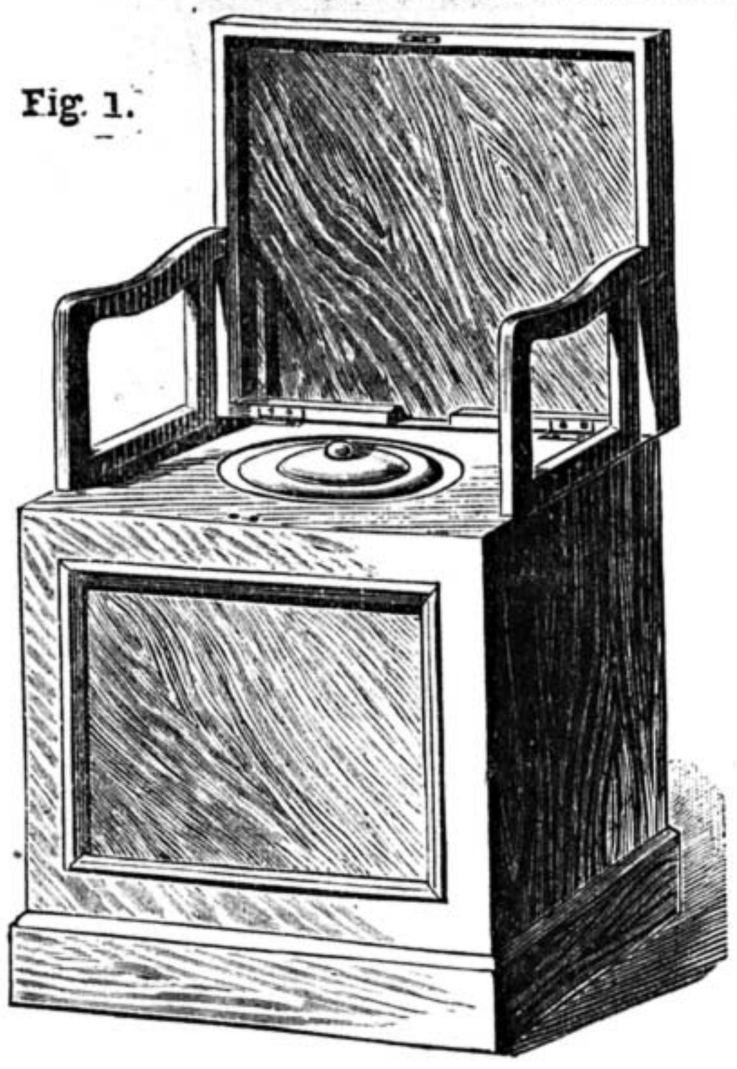

Fig. 2.

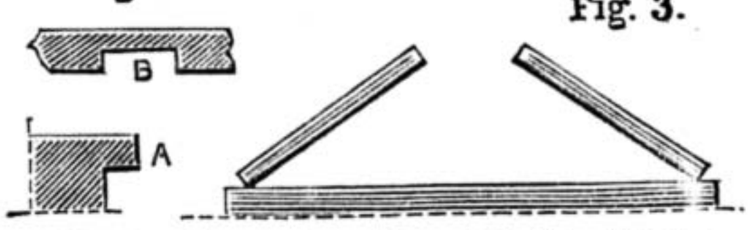

Fig. 3.

Fig. 1.—Commode. Figs. 2 and 3.—Details.

trifle less than half the width of the commode top. Both arms are hinged to fold together as in Fig. 3. There will be a box lid, the inside depth of which will be sufficient to fit over the thickness of the arms. The sides of the lid will be flush with the side of the carcase; as also will the arms when adjusted. Were the whole depth of the back of each arm to fit close up against the front edge of the lid when they were adjusted, the lid would not close properly; therefore, the greater part of the depth must be at a distance from it equal to the thickness of a side of the lid, while at the top at the back of each arm there will be a projection as at A in Fig. 2; and to accommodate both projections when the arms are folded, a piece must be cut from the side which forms the back of the lid, as in Fig. 2, B, and Fig. 1.—J. S.

Welting.—H. G. (*No Address*).—First buff or scrape the welts well on the grain side (this is the smooth side), and then cut the pair in two, right down the centre, and put them in clean water to get well soaked through. Welts are unlike all other leather in a boot, for they must be worked wet. While wet, take them down to the substance you require them, taking this surplus off the flesh side. Then skive a piece off the whole way down, about

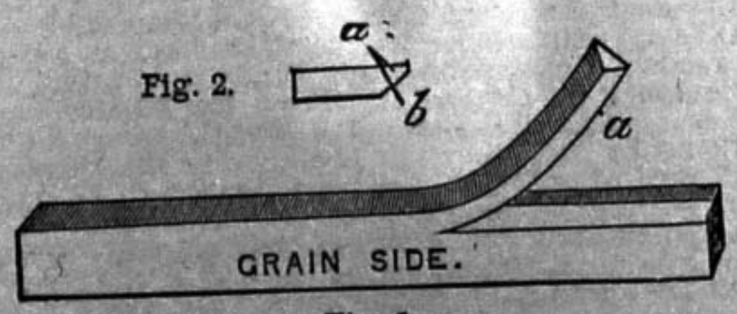

Fig. 2.

Fig. 1.

Boot Welting.

two-thirds of the way through, and about $\frac{1}{16}$ in. wide; take this off the grain side, as *a*, Fig. 1, then measure the length of the waist with it, and skive the grain off for that distance, leaving the welt half the substance in this place as that which is going round the forepart. When you have sewn in the welt round to the other side of the waist, skive the other end the same. Fig. 2 shows how the welt should look if cut through the centre, and *a b* where it must be sewn.—W G.

Italian Renaissance Overmantel.—R. H. H. (*Shutter Oak*).—A design and description of this to match the mantelpiece is in the hands of the Editor.

Polish.—S. S. (*Salford*).—In matching up satin walnut, the polisher must use his judgment, for the work can hardly be regarded as mechanical. Naturally, the stain must depend entirely on the colour or tint of the lighter parts, and of those to which they are to be darkened. As a general thing, I think you will find that a little weak brown stain will do anything you require. It can, of course, be altered slightly when necessary in colour by the addition of other pigments, according to the tints desired.—D. D.

Dragon's Blood.—HEN.—All you have to do is to put the dragon's blood in the oil.—D. D.

Polishing.—AMATEUR.—Without seeing the whatnot, it is impossible for anyone to state positively the cause of the colour having changed, and the defect in the polish. Perhaps both, especially the latter, may have been caused by the use of some unsuitable mixture as a cleanser or polish reviver, for some of these are extremely deleterious to French polish. The fault may be in the polish itself, and your description might indicate that too much glaze has been employed. Then the wood may have been damp. I can only recommend you to submit the thing to the inspection of an experienced French polisher. It is not likely that the original colour and gloss can be restored without repolishing.—D. D.

Damaged Flute.—YUCATAN.—The only means of repairing the damage described is to remove both pillars, and then cut a piece of German silver or silver plate to form a new base for them; cut away the wood round the broken part and between the pillars to shape of plate to form a seating for it, so that it may lie flush. Then solder on your pillars (with silver solder), and screw the plate into position with three small screws. The plate would look best if oval in form, but you will be guided as to this by the size and shape of the broken part. Unless YUCATAN is a very expert mechanic, we should advise him not to attempt letting in a piece of wood. He would almost surely spoil his instrument, whilst there is no great difficulty in the plan suggested above. The key pads of wind instruments could not be made in the way described. The cardboard would be too hard to take the impression of the keyhole, and would, consequently, not be air tight. The best pads are skin pads, *i.e.*, a fine skin drawn over wadding. These pads are mostly imported from abroad, as it is difficult to procure skin of the proper thickness here—the bladder skin referred to by YUCATAN being too stout, and gold-beaters' skin too fine. The pads most generally used, however, are made from lamb skin. The cuttings from a glove manufacturer's answer admirably.—G.

Triple Optical Lantern.—J. P. (*Blackburn*) and others.—Messrs. T. S. & W. Taylor, Slate Works, Leicester, can supply the entire lantern fronts ready for attaching to the woodwork at the following prices:—A pair of fronts for the lower or twin lantern, well finished in brass, with adjustable slide stages open at the top and sides, and fitted and hinged together ready for 4 in. condensers, £1 18s., or with double or triple draw tubes (for convenience of focussing when lenses of varying foci are used), £2 8s. and £2 18s. respectively. If a rolling curtain diaphragm is fitted to either of the above, the charge will be 5s. extra. The cost of the remaining front for the top lantern will be proportionate to the above. Readers desirous of fitting the lanterns with these ready-made fronts will do well to obtain them previous to cutting the condenser openings in the wood work, as it may be necessary to plant the latter in a slightly different position in order to suit the fronts. Messrs. David Noakes & Sons, Billingsgate Street, Greenwich, are also willing to supply amateurs with all parts required in the construction of lanterns.—C. A. P.

Whetting Gravers, etc.—S. T. R. (*Dursley*).—The graver should have been a "lozenge" one. You will, no doubt, be able to cut a sufficiently fine line with the one in question. Yes. The ordinary eye-glass is much used for small work, but for large work a larger glass is used, mounted on a stand with a projecting arm, which can be raised and lowered, and also swivelled round in any direction circumstances may require. The letters cut with a flat bottom are done with a graver whetted at an acute angle like the one sent, and then flattened off to the required width. A great deal of cheap lettering is done with a shading graver of the required width of cut, and then finished with the ordinary angle graver. Use a much shorter graver than the one sent, and, by the way, you will find our English gravers quite as good as those of foreign make.—N. M.

Decorating Overmantel.—APPRENTICE.—There can be no objection to your decorating the top panel of the overmantel you have made with fretwork. This should naturally be of such a character that it will harmonise with the rest of the design. I am inclined to think that by "top panel" you mean pediment, in which case if the overmantel is a tall one you will probably find a few bold lines and broad treatment more effective than a quantity of small niggling work.—D. D.

Squeezing Wax.—F. W. H. (*No Address*).—Take half a pint of boiled linseed oil, half a pound of best beeswax, two ounces of Burgundy pitch, two pounds of best flour, and one pennyworth of

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dragon's blood. Cut the wax into thin slices, place it an earthenware pot along with the boiled linseed oil and Burgundy pitch, and melt slowly. When the ingredients are thoroughly well blended, put the flour on a tin tray, and pour the mixture gradually in, rubbing the flour thoroughly well into it. It is difficult to mix wax quite properly, but very good wax can be obtained ready mixed from a carver—say W. Angus, Northumberland House, Purves Road, Kensal Green, W., at 2s. 6d. a pound. Orders must be accompanied by the money and postage.—M. E. R.

III.—Questions Submitted to Correspondents.

Feather Sorter.—C. J. (*Birmingham*) writes:—"Kindly tell me, any reader, how to make or where to buy a cheap feather sorter and duster for hand-power to take about 20 lbs. or 30 lbs. at a time."

Printing on Tin.—D. E. E. (*Banchory*) writes:—"Will any reader kindly give me any information regarding the process of printing on tin? I am led to believe I am to be put on such a job shortly, and not having done such before, a tip or two from you might come in handy. The job will be in three or four colours."

Frosting.—Beta writes:—"Would any reader kindly let me know how to frost or obscure glass (windows)?"

Lacquer for Brass.—Patience would thank anyone who would tell him the receipt for a good lacquer for brass.

Indiarubber Ornaments.—Adie writes:—"Will any reader kindly tell me how to melt and mould indiarubber for making ornaments, etc.?"

Browning Gun Barrels.—C. B. F. (*Seacombe*) writes:—"Will any reader give me information through 'Shop' on browning gun barrels?"

Photography.—C. E. H. (*Horwich*) writes:—"Some two years ago I saw an advertisement in a paper about painting photographs on glass; it was not crystoleum, but was a word that sounded like "trans-toleum." I quite forget the word, but it was a new way to paint photographs. It was somewhere in London, and they supplied you with work. Will any readers kindly tell me what they know about it."

Joiners' Bits.—A. A. W. (*Leicester*) writes:—"Will some reader give me a list of the bits joiners use for boring purposes, their name, and what they are used for, and why? I notice there are several kinds of twill bits (I think that is the name). Is one better than another in certain cases, and why?

Soldering.—Northerner writes:—"I shall be very glad of a few hints regarding the hard soldering of delicate articles. I do not manage so well as I could wish, and shall be very thankful for a hint or so from one who knows. I should like to know, for instance, how a thin gold bevel for a Geneva watch is repaired when it is broken. My method of doing it is to fasten the bevel down to a charcoal block—the ends together—then apply the borax, and when it has gone all round, lay on the solder; but here I, not long since, miserably failed, as I found to my cost, for a new bevel had to be bought. Whether the solder was too hard for the gold or not, the bevel was spoilt and could not be repaired. I generally have little difficulty in doing solid rings or articles of some substance, but fragile pieces I generally fail in. I use a spirit-lamp and ordinary blowpipe. I should also like to know how spectacle frames are treated after soldering in order that the blue may be of even shade, and the usual method of bluing. I have seen boracic acid mentioned in the hardening of small steel articles. Is it simply used as a flux to prevent scaling, or is it for some other purpose?"

Silk.—J. S. (*Ramsbottom*) writes:—"Can you inform me (*a*) How to keep silkworms? (*b*) Also the best way to dispose of the silk profitably? (*c*) Also where to procure the eggs? (*d*) Being a cotton weaver, would it be best to weave it myself?"

IV.—Questions Answered by Correspondents.

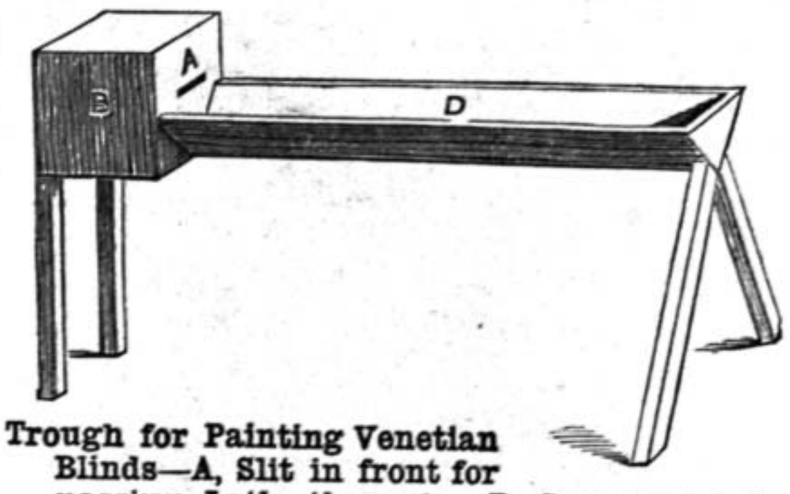
Bursting Water-Pipes.—G. F. Underwood (*Habberley Road, Kidderminster*) writes:—"In reference to bursting water-pipes (see No. 86, page 554), if Glasgow will give or send me his address, I will send him sketch of a valve of my own invention that I think will fulfil his requirements."

Picture-Frame Moulding.—J. H. B. (*Pendleton*) writes, in reply to H. R. (*Bacup*) (see Vol. II., No. 83, page 506):—"I have found Mr. G. Williams', 9, Albert Bridge, Manchester, a good shop for the above."

Patent.—F. A. E. (*Tufnell Park*) writes, in reply to G. L. S. (*Darlington*) (see page 686, Vol. II.):—"Messrs. Ayrton & Thomas, of 9 and 10, Southampton Buildings, London, W.C., are trustworthy; they are taking out my father's patents all over the world. They publish a book called 'The True Position of Patentees,' 1s., post free."

Heating Tools.—W. H. P. (*Hornsey*) writes, in reply to A. T. M. (*Lichfield*) (see page 686, Vol. II.):—"If he has access to a kitchener, he will find it answer well to let the ends of the tools rest on the top of range. If not, an iron shovel placed on top of an ordinary fire will do as well; he will find the tools keep much cleaner this way than putting them in the fire."

Venetian Blinds.—G. H. (*Liverpool*) writes, in reply to Aspirant (see No. 84, page 522):—"You can make a 'boat' for rapidly painting Venetian blinds in the following way:—Make a wooden trough with V-shaped ends (say about 6 in. or 7 in. deep) of any convenient length, 3 ft. or 4 ft. long might do, to hold the mixed paint, supported on legs, and at the left-hand end place a wooden box made to hold two ordinary scrubbing brushes placed one over the other face to face, allowing just sufficient room for a Venetian lath to pass comfortably between them. The lath is first dipped about one-fourth of its length in the paint trough to take the paint, and then



Trough for Painting Venetian Blinds—A, Slit in front for passing Lath through; B, Box containing Brushes; D, Paint Trough or Boat.

passed through the opening in the box, passing between the brushes and out at the back of the box, being caught by finger and thumb of both hands on its edge at each end as it passes out, so as not to rub off more of the paint than can be avoided; the lath is then hung on projecting rods to dry, the rod passing through the holes in the lath. Top and bottom rails are usually painted by hand. Brushes must be so fixed in box as to be steady and not move when laths are being passed through. I send small sketch, and hope the hints may be of service to Aspirant, but would strongly advise Aspirant, if he takes up Venetian blind painting and making for trade purposes, to add upholstering to it, as the Venetian blind trade is so cut up nowadays that it requires one's utmost care and economy to make it pay."

Coloured Patterns on Canvas.—J. H. B. (*Pendleton*) writes, in reply to To Po (see Vol. II., page 554):—"To Po will find Briggs' patterns useful. They are sold on sheets of white tissue paper, and are stamped by applying a hot iron to the back. Books of patterns are kept by most small-ware dealers."

V.—Brief Acknowledgments.

Questions have been received from the following correspondents, and answers only await space in Shop, upon which there is great pressure:—T. H. S. (*Dover*); A Reader (*Hackney*); E. H. H. (*Chatham*); J. H. S. (*Romsey*); L. U. N. (*Liverpool*); A. T. (*Burnley*) J. E. A. (*Aldershot Camp*); Varnish; Veneer; Lux et Veritas; W. W. (*Bradford*); T. T. (*Birmingham*); Puck; W. J. (*Heaton*); A. M. (*Stoke-on-Trent*); Talbot (*Highgate*); H. S. O. (*Hammersmith*); J. J. M. (*Ebbw Vale*); W. J. C. (*Islington*); W. G. (*Barnsbury*); A. J. S. (*Edinburgh*)

Trade Note.

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Department of Technical Instruction.

Building Construction and Architecture.

The Carpenters' Company, acting in connection with the Council of King's College, London, have resolved on establishing at King's College in the Strand, Evening Lectures on Building Construction and Architecture, and Drawing Classes. Lectures:—These will be given on Mondays, from 7.15 to 8.15, by Banister Fletcher, Esq., F.R.I.B.A., Professor of Building Construction and Architecture at King's College. Each Course will last twelve weeks or thereabouts. Subjects:—Foundations, Brickwork, Building Stones, Timber, its various forms and use, Iron, and its use in Building, Plumbing and Sanitation, Limes, Cements and Concrete, Masonry, Fireproof Construction, Carpentry (roofs and their construction), Plastering and Materials, Architecture and its History. Fee, £1 1s. for each Term.

Drawing Classes and Classes of Design.

These will be held on Mondays, from 8.15 to 9.15, by Professor Banister Fletcher, assisted by a Demonstrator. The Lecture Room, Museum, and Library, will be open free to all students on Friday evenings for Sketching and Study from 7 till 9, the Demonstrator attending. Fees, 10s. 6d. for each Term. Students nominated by the Carpenters' Company for either the Lectures or the Drawing Classes will pay half fees. Application to be made in writing, giving particulars of circumstances, to S. W. Preston, Esq., Clerk of the Company. There will be an Examination at the end of each Term. At the end of the Academical Year, Certificates, money prizes, and silver and bronze medals will be awarded, provided the work is of sufficient excellence. The First Course began on Monday evening, January 19th, 1891. All fees must be paid in advance on the first day of each Term, at the Office of King's College, at which place, as well as at the Hall of the Company, further particulars may be obtained. Those attending the Lectures or the Drawing Classes will have the advantage of a Technical Reference and Lending Library, the Librarian attending each Monday evening.

J. W. Cunningham,
Secretary of King's College, London.
S. W. Preston,
Clerk of the Carpenters' Company.

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The Jurors: How Appointed.
The Jurors' Awards, "Work" Exhibition, 1890-91.

To those readers of Work who have been unable to see the Exhibition itself, this Special Exhibition Number will be of particular value and interest.

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Paper Letters, Rubber Stamps, etc.—Agents should apply for samples (free).—Willcox Brothers, 172, Blackfriars Road, London, S.E. [2 S

How to Make a Dynamo.—Third edition, illustrated, 2s. Price lists of Dynamo Castings, Stampings, Wire, &c., 1½d. post free, from Alfred Crofts, Electrician, Dover. [3 S

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